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Rotavating in Mexican Marigold

VOLUME 5, No. 7 **JULY 1953**

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WORLD CROPS

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Vol. 5. No. 7. JULY 1953

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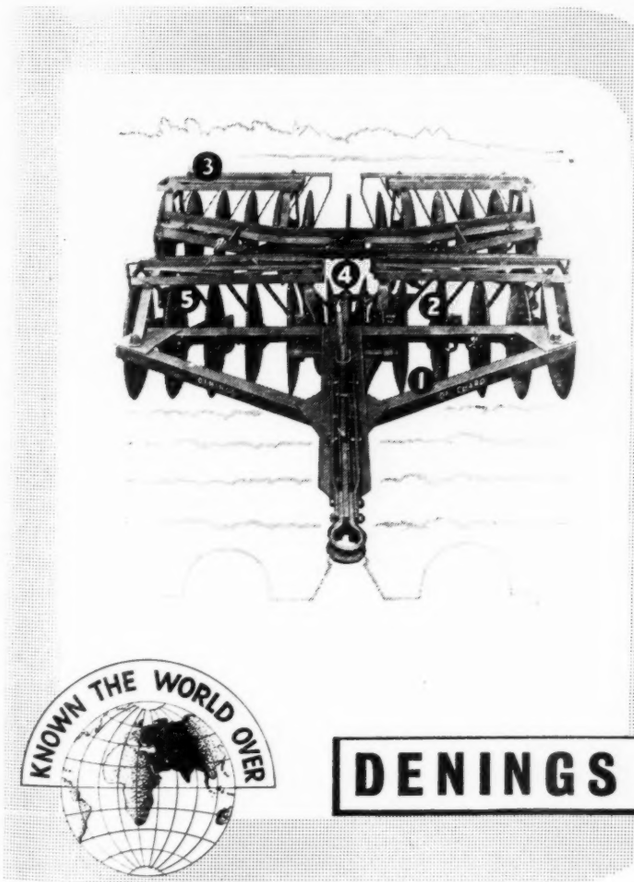

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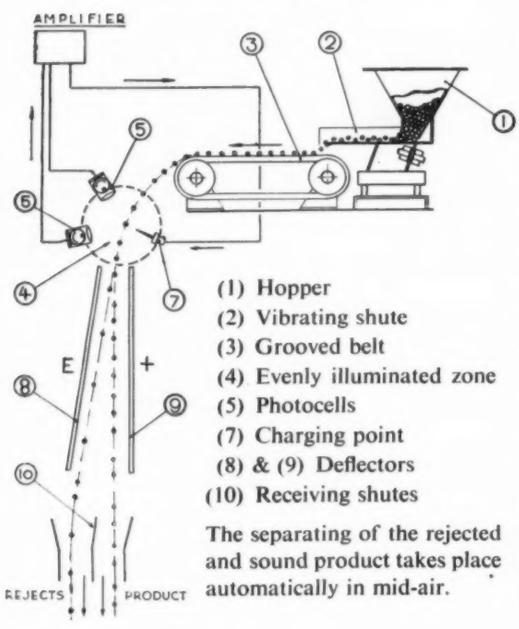

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Editorial Comment

The Colonial Development Corporation

THE annual report for 1952 of the Colonial Development Corporation is once again an interesting albeit a somewhat depressing document. Last year's report, the first issued under Lord Reith's chairmanship, contained a lengthy record of abandoned projects and heavy losses, but it was optimistic, however, to the extent that it foreshadowed that 1951 should constitute the peak of loss in the corporation's operations. Commenting on this forecast the present report offers the sardonic but somewhat comfortless observation 'Events have taught us better!' No one would indeed gainsay that recent events convey a number of valuable lessons provided, of course, that those who read are also willing to mark and learn.

Trading losses of the corporation in 1951 were £638,747 compared with £643,404 in 1951, while the consolidated operating loss was £1,097,091 against £1,070,043 in 1951. The cumulative consolidated deficiency of the corporation now amounts to £8,399,807, truly comparatively small compared with the colossal extravagances of the corporation's sister the Overseas Food Corporation which, in the short space of three years, poured £35 million of British taxpayers' money down the East African drain, but nevertheless it is by itself not inconsiderable.

Last year, nine of the projects originated under the earlier administration of the corporation were reported to have been abandoned this year. They have been followed by a further eight projects bringing the total of enterprises abandoned to seventeen. Actually, nine new projects were started during the year so that the total number of projects in existence is now 57, but the tale of abandoned projects makes rather a sorry story.

The Gambia rice project

IT is somewhat difficult to understand the principle on which the corporation is operating. Apparently, no projects can be entertained unless they show definite prospects of ultimately becoming a financial success and providing a return on the capital invested. It was on this account apparently that the corporation decided to abandon the project for developing a rice farm in the Gambia, a decision which at first sight appears somewhat unfortunate because the possibility of developing rice cultivation in the Gambia seems to hold out considerable promise, especially considering the importance of increasing world rice supplies in view of the critical outlook for this commodity.

A special mission examined the project in 1952 and advised that it should not be abandoned, but notwithstanding this the corporation has decided to abandon it, mainly because, apparently, its continuation would involve further expenditure amounting to £150,000 spread over the next three years. It means, apparently, a dead loss of £1,115,000 in addition to the expenditure on the earlier ill-starred project for the development of a poultry industry in the Gambia which involved the loss of £910,000 without any corresponding gain. Thus, in the short space of three years, it would seem that a sum of over £2 million has been expended on the small dependency of the Gambia without any commensurate return.

Certainly, rice is a crop for which natural conditions in the Gambia are particularly suitable provided facilities for water control on an adequate scale are provided. One is impelled to hope that as foreshadowed in the report the Gambia Government, which is reported to be considering the matter, may be able to devise some means whereby the irrigation works already completed may be taken over and operated so that the project may not become a dead loss.

It is somewhat startling to discover in these conditions that the corporation is now embarking on a fresh project in the Gambia for the establishment of a 400-acre experiment station for trials with crops such as milletts, sorghum, cotton, tobacco and market garden crops (but from which rice seems to be excluded), and also certain aspects of animal husbandry. One wonders whether the corporation is informed of the work carried on at the Government Experiment Station at Yoroberi Kunda on the mainland opposite Macarthy Island during the past twenty years or so. It has, on occasion, been handicapped by lack of funds, but that is not to say that the results obtained there previously are completely valueless and can be disregarded.

Moreover, it is hard to believe that the corporation can imagine that an experiment station such as this is planned to be can ever expect to yield a satisfactory financial return on the capital invested in it. The return from a satisfactorily operated experiment station should be in new and valuable knowledge, and it is vain to expect it at the same time to give a financial profit. This being so, would it not appear that the corporation may be envisaging some departure from the principles of operation which have been laid down for it ?

The basis of operation

THE great awakening on the part of H.M. Government to the debt which is owing to the less-developed colonial dependencies, in the course of the last twenty years or so and which has led successively to the inception of the various development, welfare and research schemes, as well as of the Colonial Development Corporation and the Overseas Food Corporation, are as welcome as they were long delayed. Many of the earlier workers in the field of colonial development may well contrast with a sense of longing the present almost cathartic easement of the Government purse strings in favour of new schemes with what prevailed in their time when money for research and development was almost as difficult of extraction as the proverbial drop of blood from a stone. Nevertheless, those earlier workers with scant resources seem to have accomplished a great deal; more, perhaps, than has so far followed some of the lavish projects of recent times.

In those far off days it was customary for the technical worker and administrator to be imbued with proper respect for financial provision. A sixpence was an object to be contemplated with awe and expended at peril. There certainly is something to be said for this point of view, and it might be well for us if this spirit of parsimony became a little more widely accepted as necessary, for necessary although unpleasant it seems to be at present.

As is pointed out in an article on the French scheme in the Niger Delta in this issue, the example of British development projects in her overseas dependencies are being closely watched on the other side of the English Channel and the numerous failures which have followed so many schemes lately are having a depressing effect on similar schemes undertaken by other Colonial powers. It would be a dreadful thing if, as the result of badly-laid plans, the efforts to raise the productive level of the British Colonial Dependencies should prove sterile.

May it not be that the time is ripe for a thorough overhaul of the machinery so far devised for implementing Colonial Development Welfare and Research ? And may it not also be that in devising plans for the future full advantage should be taken of the considerable store of knowledge and experience which is locked up in the minds of many officers who have spent their lives in development work in the Colonies, and have since relinquished their posts, often to take service with other and unconnected agencies.

Rubber and the U.S.A.

THE trenchant remarks of Sir Sydney Palmer, this year's chairman of the Rubber Growers' Association, will have been read with sympathetic feelings by many interested in the present position of the plantation rubber industry. Referring to the recent fall in rubber prices, Sir Sydney pointed out that the present position is very discouraging to both large and small growers. There have been some small increases in estate production, due to labour migration from small holdings, which, coupled with improved security conditions in Malaya, have made estate employment more attractive, but there has been a more than equivalent falling off in small holding production, which, in Malaya, dropped by more than 30,000 tons. The consumption of natural rubber in 1952 dropped by 45,000 tons compared with 1951, while only 454,000 tons were absorbed by U.S.A. manufacturers.

Sir Sydney went on to remark that the reopening of the high cost alcohol-based synthetic plants in the U.S.A. of which the product is sold at prices far below the cost of production is in large measure responsible for the present disappointing offtake in the United States and consequently for the disastrous decline in the price of rubber, which is having so serious an effect in lowering the Asian standard of living and opening the door for Communist propaganda which informs the native inhabitants of the remotest villages that their difficulties are due to market manipulation by American financiers who are heedless of the sufferings of the masses.

It certainly seems ironic to one who remembers the outcry in the United States against the operation of the Stevenson rubber restriction scheme in the 1920s, which was alleged to be forcing up the price of rubber against the American consumer, that the American Government should now be forcing down the price of natural rubber by subsidising the uneconomic production of synthetic rubber substitutes, regardless of the effect which it may have on the world political situation and the risk of war, to say nothing of the fact that the depreciation of natural rubber uneconomic prices cannot continue indefinitely. It is to be hoped that the meeting of the rubber study group recently concluded in Copenhagen may exercise a favourable influence on a situation which gives cause for grave anxiety.

Fabrics and fumigation

AS a sequel to wars throughout the ages, belligerent peoples have inevitably found themselves on the conclusion of hostilities in possession of large quantities of materials for which under peaceful conditions no employment can be found. In consequence, a premium is usually placed upon finding uses for war-time materials in substitute roles other than those for which they were designed. The classic instance is the advice to turn swords into ploughshares; a more modern example is that recently described by Messrs. Thompson and Turtle of the Infestation Control Division of the English Ministry of Agriculture, in a paper in *Chemistry and Industry*, of the use of surplus balloon fabrics for making gas-tight sheets for covering stacks of bags containing foodstuffs which have been infested with insects which attack foodstuffs and need to be fumigated.

Earlier experiments were made with oil-dressed tarpaulins but difficulties arose on account of the weight and stiffness of these, the latter defect preventing the making of a satisfactory gas-proof joint. Balloon fabrics were found to be superior to tarpaulins in many respects, and when they became available it was found possible to cut them to form nearly flat sheets approximately 30 ft. by 40 ft. weighing about 140 lb. The fabric in question was a three-ply cotton material proofed on each side with natural rubber and impregnated with aluminium on the outer side, as used for making the barrage balloons which were such common sights over large cities during the last war. When field trials had shown the use of these materials to be practicable, the use of still larger sheets of a two-ply rubberised fabric was successfully essayed, and since then still lighter two-ply rubberised fabric as used for inflatable rubber dinghies has become available.

It was found that by using sheets of this type the successful fumigation of infested stacks of bags with suitable fumigants could be carried out, *e.g.* methyl bromide, ethylene dioxide, carbon dioxide. An example where this method of treatment was used with success was that of the famous groundnut pyramids at Kano in Northern Nigeria, which accumulated owing to shortages of rolling stock on the Nigerian railways preventing bags of groundnuts being moved to the coast for shipment, and which in due course had to be treated to rid them of the destructive insects with which they had become infested.

EAAFRO achievements

THE report for 1952 of the East African Agricultural and Forestry Research Organisation has recently appeared. It is not our intention to attempt a review of this document here; we shall hope to do so in some detail in a subsequent issue of WORLD CROPS. A perusal of the report has, however, left us with the feeling that if the indications given in it are to be relied upon, and far be it from us to suggest that they are not, in the space of four years the organisation has accomplished with outstanding success two important objects.

In the first place, it has demonstrated that the general scheme for the organisation and functions of EAAFRO which differed markedly in conception from any previous similar efforts in the Colonial field, have been abundantly justified. These, we may remind our readers, were the setting up of an organisation which, although it would be based upon a centrally situated headquarters, nevertheless would not be bound to carry out the majority of its activities there, but rather depended on the setting up of *ad hoc* research teams to perform specific researches for definite periods on particular problems as they appeared at different points in the East African environment.

In the second place, it has succeeded in establishing this organisation in East Africa under very great difficulties. These were both administrative and political. On the administrative side, owing to the rise in the cost of living, the originally foreseen provision of funds proved totally inadequate for the realisation of the project on the scale envisaged, and had to be considerably supplemented. On the political side, endless difficulties have been experienced owing to the outbreak of the Mau Mau rebellion among the Kikuyu tribesmen. The site selected for the headquarters of the organisation at Muguga, lies in the Kikuyu reserve and hence is peculiarly vulnerable. We learn that many members of the staff joined the Kenya Police reserve and that routine and short notice night patrols and similar emergency duties became regular features which caused interruptions in the programme and which might well have proved serious and constituted a handicap to the research work.

One can heartily agree with the director, Sir Bernard Keen, in his dictum that the fact that the adverse effect of the emergency on the work of the organisation has been held at such a low level is a tribute to the determination and enthusiasm of the scientific and administrative staff. Indeed one can go further and on the report express the view that the range and quality of the research accomplished is amazing considering the conditions.

Clove research in Zanzibar

ONE of the activities originated under the aegis of EAAFRO was the scheme for investigating the problem of the mysterious malady known as 'Sudden Death of Cloves in Zanzibar,' which for something like forty years defied the investigations of a series of research workers, and on which we have on more than one occasion commented in these columns.

With the establishment of EAAFRO, a team was organised to investigate this malady afresh, under the direction of Dr. F. J. Nutman. This team is now reported to have completed its labours and to have brought the research to a point where technological investigations for the practical control of the disease can be begun. The problem in essence comprises two separate diseases, one of these, known as Die Back, has been shown to be due to a fungus malady known as *Cryptosporella eugeniae*, and methods for its elimination have been successively demonstrated.

The second and more serious malady is termed Sudden Death and apparently can cause the death of clove trees with almost catastrophic rapidity. It was for a time believed to be caused by some obscure form of virus malady, but this view was disproved by Dr. Nutman and his team and another fungus *Valsa eugeniae* was incriminated. Experiments have been laid out for the control of this disease and it is considered that these now constitute a routine investigation which can safely be left to the Zanzibar Department of Agriculture.

The successful elucidation of a disease problem which has puzzled successive generations of research workers must be counted as one of the major achievements of agricultural research in the Colonial field, and felicitations are due to Dr. Nutman for its achievement. That it has been accomplished under the auspices of EAAFRO is definitely a feather in the cap of that organisation also.

Agriculture in France

A RECENT article in the London *Financial Times* discusses the present position and trends of agriculture in France and contrasts the position with that in the United Kingdom. On this we base the following observations. France is three times the size of the United Kingdom, while the area under cultivation is approximately 130 million acres; her agricultural population is only narrowly outnumbered by the urban population which depends on the agricultural population for practically the whole of its food supply.

Agricultural imports consist mainly of vegetables and textiles, but if French agricultural land could be farmed as intensively as is land in England, it could export enough food to meet the requirements of some 40 million people. This gives matter for reflection; in the United Kingdom the dependence on imported food and other agricultural products has forced the pace of agricultural improvement and has caused British agriculturalists to play a much more important and predominating part in national politics than is the case with their French opposite numbers.

International influences and in particular O.E.E.C. have not unnaturally taken the view that France is ripe for intensive development and in 1949 they drew up plans which set the target of an increase of 16% on pre-war production by 1953. The principal points in this programme were: (1) the consolidation of holdings which have become unduly fragmented as a result of French laws of inheritance,

(2) the increased mechanisation of French agriculture and (3) the threefold increase of the use of fertilisers.

It can hardly be said that the target set has been fully realised, nevertheless substantial progress has been made. Annual investment in agriculture now exceeds £150 million per annum, fertiliser consumption has doubled, livestock numbers have increased and livestock exports now exceed 200,000 tons per year, while as an exporting nation under the International Wheat Agreement France has achieved since 1949 a sizable surplus.

The most notable achievement, however, has been the increase of mechanisation; today 100,000 more tractors are operating in the field than was the case five years ago, while tractor makers have greatly increased their output and at least one British firm, Harry Ferguson and Co., has opened up a new factory for assembling its machines near Paris. The tempo of increase of production in France is much less rapid than in Great Britain. In fact, the rate of increase in agricultural production in France is only 2% per annum, as compared with 4% in the United Kingdom. Nevertheless, in view of the difference in the urgency of the situation this cannot be counted as unsatisfactory.

Southern Rhodesian tobacco

THE pronouncements of politicians are particularly prone to be refuted by the logic of events. A few years ago, Mr. Hugh Dalton, in the then existing Socialist Government, remarked that he would sooner see Southern Rhodesia grow more maize than more tobacco, while the Southern Rhodesian Minister of Finance attempted to impose a 'disinflationary' export tax on tobacco. Despite these prognostications and tendencies recent developments have been in exactly the opposite direction, for the tobacco industry of Rhodesia continues to expand and tobacco is now by far the most important item of export. The crop that passed over the auction floors this season reached the record total of 108 million lb., while, amazingly, Salisbury is expected to be able to claim beyond dispute this year to be the world's biggest tobacco marketing centre.

Tobacco is apparently now fully assured of complete recognition by the Government as the principal mainstay of the Colony's economy. There may, of course, still be some who, on grounds of economic theory, deplore dependence on a non-food product and the predominance of tobacco over maize which was formerly accounted to be Rhodesia's principal product and export. The economics of the position, however, have recently been examined by Mr. W. E. Haviland of Nuffield College, Oxford. In his report, he expresses the opinion that 'tobacco is the only agricultural export that Rhodesia has so far found that can bear the high cost of transport in a land-locked economy and at the same time finance the development of the country. Growing more food in place of tobacco would probably mean a damping down of the rates of capital accumulation and economic development.'

With all of this many of us would probably heartily agree, were it not for the risk of international strife or economic crises, when prices for export commodities like tobacco, rubber or cotton become proportionately more deflated than those for foodstuffs. In either of these conditions excessive dependence on a non-edible export commodity may bring in its train hunger and want.

In these uncertain times, an economy which can produce for itself as large a proportion as possible of its domestic requirements of food may, despite arguments to the contrary, still seem to many to be more soundly based than one which depends on exporting non-edible staples to provide the exchange to purchase the food it needs from outside sources.

Insecticidal residues on vegetables

A DETERRENT to the wider use of some of the powerful new insecticides is the risk that potentially dangerous residues may be left on food crops after harvesting. Ways of overcoming this hazard have been examined by Dr. V. G. Heller, of Oklahoma Agricultural and Mechanical College, and R. A. Nyquist. Their conclusion, given in a paper at an American Chemical Society meeting, is that washing and cooking vegetables before eating is 'very effective' in removing possible harmful insecticide residues. According to them, in recent tests, as much as 97% of the residue of insecticide on vegetables was removed by thorough washing and cooking in an open kettle. Washing and pressure cooking were not so effective; nevertheless, they removed 60% to 95% of the residue. Freezing the vegetables also reduced the residue.

Two of the newer insecticides—parathion and lindane—were studied in the tests, which were conducted at the Oklahoma Agricultural Experiment Station, Stillwater, Oklahoma. 'The toxicity of these insecticides is such that we cannot dismiss the possible dangers of indiscriminate use. However, these data would indicate that under proper conditions of spraying, harvesting and processing such foods there would be a very small probability of the existence of dangerous quantities of spray residues.'

The amount of insecticide on plants decreases shortly after its application, because of the action of sunlight, oxygen in the air, temperature changes and rainfall. The residue of insecticide is further reduced during the various processing operations. 'The greater the amount of insecticidal residue present on the vegetables, the greater is the percentage of the residue which is removed by processing. As the deposit decreases, it becomes harder to remove.'

Heller and Nyquist found that washing was very effective in reducing the amount of residue, since the residue is at a relatively high concentration before washing. By simply washing the vegetables three times, the residue was reduced by 50% to 75%.

It is fairly clear that these findings are of significance almost solely for vegetables destined to be factory processed. Only under such conditions could there be any guarantee that the vegetables would be processed sufficiently to remove insecticide residues. Market gardeners whose produce is sold raw to the public will still be wary of using synthetic insecticides.

The Witchweeds of Africa

K. WILSON JONES, M.Sc.

Economic Botanist, Research Division, Ministry of Agriculture, Sudan Government

The parasitic weed known as witchweed (Striga) has for long been a source of difficulty in cereal crops in Asia and Africa. In this article, Mr. Wilson Jones, who has himself been engaged upon research on the problem of its control, reviews the present position.

THE genus *Striga* belongs to the series Rhinanthae of the family Scrophulariaceae, and includes 49 species according to the Index Kewensis and supplements up to the year 1940. All are more or less parasitic on the roots of other plants, and the distribution of the genus seems to be confined to the Old World tropics of Africa, India and South-East Asia, the East Indies, and Australia. The most important species economically are parasites of grasses, such as *S. asiatica* (L.) O. Kuntze (=*S. lutea* Lour.), *S. hermontheca* Benth., and *S. euphrasioides* Benth. The first two of these reach their highest degree of development in south and north tropical Africa respectively, as parasites of grain (mostly maize and sorghum) crops, and the third is a well-known parasite of sugar cane in India. *S. asiatica* is, however, by no means confined to South Africa; under various synonyms it has been collected from many parts of the tropical East. One species which does not parasitise grasses has been recorded as a parasite of tobacco in Rhodesia and South Africa; this is *S. orobanchoides* Benth.

The seriousness of this type of parasitism

It was not until comparatively recently, during the last 50 or 60 years, that the seriousness of phanerogamic parasitism was generally recognised. The fact of the parasitism has undoubtedly been known almost as long as the species themselves, but the actual losses to the cultivators as a result of the parasites' depredations have only slowly come to light. The first notes of warning were sounded in South Africa, where Fuller[1] in 1900 recommended that witchweed should be attacked by farmers as a matter of urgency. Pearson[2] in 1913 carried out some experiments and complained that nothing had been done about the parasite during 30 years, in which time it had been spreading steadily through the sandy lower-rainfall areas of the Union, and pressed for vigorous weeding of the plants wherever found. In 1933, Saunders[3] produced a very exhaustive summary of previous investigations, and by artificially infesting actual field plots was able to show the full extent of the damage which could be caused by the parasite even on land in good heart. It is probably true to say that more effort has been put into researches on *Striga* in South Africa than anywhere else. The most likely reason for this is not that *S. asiatica* is a worse parasite than are the other species, but that there are more farmers there who are of European descent. A native cultivator, although he may have a very good idea of the cause of the trouble, or at least correlates a large number of *Striga* flowers with a poor crop, often finds it difficult to put his ideas across to an administrative official, who all too often dismisses the whole subject as ' soil exhaustion.'

Striga hermontheca, in flower on grain sorghum plants

Striga hermontheca

Perhaps it is this attitude on the part of authority, coupled with the absence of educated farmers who can explain their ideas, which has led to the comparative neglect of the related *S. hermontheca*, which lives mainly on the southern fringe of the Sahara, but spreads as far south as Tanganyika. Like *S. asiatica*, it prefers the sandier soils of low rainfall, though it can be very serious indeed on the heaviest clays. Unlike *S. asiatica*, there is a widespread belief that the damage it causes is unimportant, and many authorities have gone so far as to state specifically that it only appears in strength on soils which are already worn out as a result of overcultivation. This seems to be largely a matter of conjecture, for the continuous cultivation of grain will certainly enable a large population of *Striga* to be built up; soil exhaustion unaccompanied by erosion, down to the point where cropping is impossible, remains to be proven. Unless the *Striga* can be removed from a field it is impossible to say how far a reduction in yield may be attributed to soil exhaustion.

Life history

The species *S. asiatica* and *S. hermontheca* are undoubtedly the best known and most studied, and bear a considerable resemblance to one another in their mode of life. The flowering aerial shoots are seen among the bases of the host plants, usually about the time of flowering of the host. Both species have flowers varying in colour from almost white to purple, but with reddish colours predominating; both have green stems bearing green reduced leaves and bracts and are technically only hemiparasites; both attack the same grain crops. The flowering stems appear about five or six weeks after the sowing of the crop, such as maize, sorghum or bulrush (*Pennisetum*) millet. If the attack is light, the crop will grow tall and bear almost normally, but if the attack is heavy the crop may fail to grow even as tall as the parasite—2 feet. The stems of the parasite bear flowers along their whole length with the exception of the basal few inches. The seed pods have been reported to contain 700-900 seeds each, and the total seed-production of an average plant seems to be in the region of 40,000 to 50,000, for both species.

Propagation

The seed, which is extremely minute, lies where it has fallen on the ground, and eventually gets buried in dust and crop debris. It requires a considerable period for ripening before it will germinate at all; very little will germinate in the first year after shedding, but thereafter the rate

increases with age. The seeds of both species can live in the ground for at least ten years, and apart from a very small amount of 'spontaneous' germination which has been observed in laboratory studies, the seed will not germinate except in the proximity of a plant (usually a host) root. The host root, in its growth, produces a secretion which stimulates the germination of the *Striga* seed growing within a millimetre or so of it; the radicle of the parasite then attacks the host root and forms a haustorium. Parasitic connection is eventually made with the xylem of the host.

Several weeks are then spent underground by the young *Striga* seedling, during which branch roots are produced which search through the soil for further host roots. Meanwhile, the young stem grows slowly. Enormously thickened in comparison with the aerial stem which it will produce later, it is heavily stocked with starch in readiness for eventual emergence and flowering. Four to six weeks after germination the young plant appears above the soil, and two weeks later is flowering. After the crop is harvested, the parasite dies. There are no known instances of these two species of *Striga* perennating even when the normally annual hosts have been kept alive beyond their normal span.

Very little work indeed has been done on the third main African species, *S. orobanchoides*. It is very widespread on a range of hosts ranging from *Ipomoea* spp. to cultivated tobacco. It is a total parasite, in contrast to the above two species, having a yellow shoot without chlorophyll, and is a smaller plant with fleshy scale-like leaves.

Cultural control

The one method of control which has been advocated from earliest times has been by means of hand weeding; pulling the aerial stems as fast as they appear above ground. This method has never been really practicable on a large scale on account of the heavy labour involved, and its use in dealing with small outbreaks has been neglected on account of the fact that a patch of infestation small enough to be dealt with in this manner is too small to apply an economic spur to work by the cultivator. By the time the patch has spread to proportions large enough to give concern to the farmer, the opportunity has been lost and hand weeding has become a major operation. In addition, from the native cultivator's point of view the weeding has at any time little to commend it. The removal of the 'weed' is tiresome in a community where leisure is held in high esteem; he sees no immediate return for his labour in the form of an increased yield in the same year, and if he fails to carry out the job systematically and prevent all seeding he will likewise see no striking return the following year. The *Striga*, being a parasite and able to draw on the food reserves of the host, is rather stimulated than weakened by weeding, which gives further discouragement to the cultivator, and finally, owing to the phenomenon of delayed maturity of the seed, not all the seed in the ground will be eliminated in a single season of pulling.

Trap cropping

A logical method of control, developed from the hand-pulling method, is that of 'trap cropping,' which is extensively practised in South Africa. It stems from the fact that the parasite cannot outlive its host. Crops of various cereals or grasses are sown at the beginning of the season in the usual manner, and allowed to grow for a month or two in the infested fields. Before the *Striga* has reached the stage of flowering the crop is ploughed in, as a green manure, to kill both host and parasite. In areas where the rains are of sufficiently long duration, another crop can be sown after this in time to produce a yield, which necessarily will be reduced on account of the lateness of sowing, but which should be much freer of *Striga*. Alternatively, 'double trap cropping' may be practised; in this a second trap crop is sown after the ploughing-in of the first. It is claimed[3] that double trap cropping for two successive seasons can virtually rid the land of the parasite. The methods, however, are only for the enlightened farmer with capital able to leave land unproductive for a considerable time, and who does not have to raise a crop every year or starve. Saunders found that the sorghums, both grain and fodder, were much more effective as trap crops than were maize and teff (Eragrostis).

Striga hermontheca, growing on wild grass, Sorghum sp.

Cleaning crops

In the northern African regions of summer rainfall where very few areas are farmed by European or other educated people these methods are impracticable, and other methods of control must be sought which do not involve such heavy outlay of capital and effort, and which will be more acceptable to local prejudice. Following the work of Rose and Lochrie,[4] who found that excretions from a number of non-host roots could induce germination of *S. asiatica* seed, Andrews[5] proceeded to show that crops of various non-hosts could exert a cleaning effect on the land by germinating numbers of *S. hermontheca* seeds in the ground, which would then fail to establish a successful parasitic relationship and so die.

In the Sudan Gezira, it was found that the local 'Lubia,' or Hyacinth Bean (*Dolichos lablab* L.) was the best of a number of crops, mostly legumes, which were tested. In Portuguese East Africa,[6] cotton roots have been found to have a powerful stimulating effect on the germination of *S. asiatica*, and the extension of cotton cultivation is being advocated on this account.

It would be most satisfactory, of course, if the stimulant could be synthesised and applied to the land before sowing the grain crop, when the seeds would germinate and die in the absence of any host roots. This seems at the moment to be a method of little more than theoretical interest, for though the stimulant has been isolated, its synthesis seems at the moment impossible, even if the cost were neglected.

Also in the Sudan,[7] it has been found that in the case of irrigated sorghum a good deal of alleviation of the damage can be obtained from heavy irrigation, for the *Striga* seedlings are very sensitive to water-logging.

This is of some assistance where such extra water can be obtained, but is clearly impossible in areas dependent upon rainfall for crop production; unfortunately, most of the areas of grain production depend on rainfall.

Two grain sorghum plants, eight weeks old. The one on the right is heavily attacked by Striga hermontheca; that on the left is healthy

Breeding for resistance

Saunders[3] reported in 1933 the existence of varieties of sorghum which appeared to possess resistance to *S. asiatica*. At the same time he reported no success in finding resistance in maize. The breeding of resistant varieties of crop plants does seem to offer an obvious solution, provided that such resistant plants can be found to serve as parents. Up to the present day, no such resistant maize has been found. In sorghum, however, a great range of degrees of resistance is to be found, and today there are a number of varieties not only from Southern Africa but also from India and the Far East generally, which have very considerable resistance to *S. asiatica*.

It might be thought that in the case of two such closely related parasites as *S. asiatica* and *S. hermontheca* which share such a large number of hosts and are so similar both morphologically and physiologically, that host resistance to the one species would be closely linked with resistance to the other. This possibility was investigated by Doughty[8] in Tanganyika, where both species occur, using *asiatica*-resistant sorghums from South Africa and Burma. He found in laboratory and pot experiments with both species of *Striga* that there appeared to be no correlation between resistance to the two species, and none of the *asiatica*-resistant types showed significant resistance to *hermontheca*. The most resistant sorghum so far bred in South Africa is one known as ' Radar '; it is an *asiatica*-resistant type. It is not, however, completely immune. In the Sudan, no breeding work has been done, but it was found in the course of field trials that a considerable degree of resistance is possessed by the variety Dwarf White Milo. It is known that in general the short-season varieties are less susceptible, and this may have something to do with the resistance; none the less, in trials on medium to heavily infested land in the Gezira it gave significantly the heaviest yield. Moreover, under a treatment which killed much of the *Striga*, Dwarf White Milo was the only variety the yield of which was not significantly increased by the treatment.

Rotation and change of crop

In the areas which are dominated by *S. hermontheca* the belief is widely held, and supported by native practice, that a change of crop from sorghum to pennisetum millets will enable grain production to continue on a piece of land so heavily infested that sorghum will no longer yield. There does seem to be some experimental evidence for this, at least in the case of the heavier soils; though it is also known that the attack on pennisetum is very heavy on sandy soils. Further experiment is required, and general statements on the ' immunity ' or ' resistance ' of the pennisetums must be accepted with reserve.

One of the big problems facing the breeder of new varieties and the introducer of new crops is the fact that people often have very strong preferences for the old crops. In the Sudan Gezira, the more favoured sorghums will fetch more than twice the price of the ' standard ' varieties in the local markets. Any new grain bred or introduced must be acceptable to local palates before it will be widely grown, unless actual famine conditions prevail. Another snag is that many sorghum varieties which are excellent yielders in their native areas may refuse to behave normally under only slightly different climatic conditions. This applies especially to local varieties developed by native tribes. Nevertheless, for many areas where *Striga* is rampant, the introduction of resistant varieties must be the first step to improvement of yields and the putting of agriculture on a sounder basis; a doubling of the grain yield means that a two-year rotation can replace a monoculture without extra land having to be found.

Chemical control

For a very long time, various chemical treatments have been advocated with the object of eliminating manual weeding, for since the parasites emerge for the most part close to the bases of the hosts, mechanical hoeing will leave large numbers of them untouched. Watt,[9] in 1909, was one of the first to use chemicals, when he sprayed the emergent stems of *S. lutea* with a 3% solution of copper sulphate. Experiments with this chemical continued in desultory fashion for 20 years without positive success; difficulties being that the kill of the emergent *Striga* plants was often incomplete, and that rapid regrowth from below soon replaces the shoots which had been killed. Saunders reported spraying trials in 1933 with sodium chlorate solutions at strengths of from 5% to 15%, which were effective in killing the *Striga* but which were also translocated into and killed the host plants. Timson,[10] in Rhodesia, found about the same time that strengths as low as 1% would suffice to kill *Striga*. Andrews,[7] in the Sudan, found that a top kill only of *S. hermontheca* could be obtained by means of a dilute sulphuric acid spray.

The drawback of all these chemical methods of control is that the chemical has to be sprayed on the well-grown parasite and, as will be clear from the above, the *Striga* spends much of its early life underground, inaccessible to weeding, while it builds up its food reserves at the expense of the host. Even though all the above-ground parts of the parasite are destroyed, the damage done to the host crop during the early stages of its life is irremediable. As was pointed out by Saunders in 1933, for success and economy, a chemical treatment will have to be directed at the parasite at its weakest stage —*i.e.* between the time of its germination and its attachment to the host. More recent work fully bears this out.

The use of fertiliser

Heavy doses of fertiliser have been reported as beneficial under conditions of *Striga* infestation. It is not known how far their effect lies in producing a stronger host which can better support the parasite or resist its ravages, and how far it is merely a matter of providing sufficient food for both host and parasite. There is always the probability that heavy manuring may improve the yield for some years, until the numbers of parasites in the ground increase to a level at which even more manure is required to maintain crop yields. Heavy doses of farmyard manure and vegetable compost have been reported much more beneficial than their chemical composition would lead one to expect, and there is the possibility in this case that either the root excretion is adsorbed or destroyed in the organic complex, so that the *Striga* fails to germinate, or that substances resembling the stimulant, produced by the organic complex, may germinate large numbers of *Striga* seeds which die in the absence of host roots.

Hormone weedkiller

With the arrival on the market of the hormone-type herbicides shortly after the war, new experiments in the chemical control of *Striga* were initiated in various places. The work followed roughly two main lines. The first method, used in Rhodesia by Martin,[11] consisted in the use of medium dosages of hormone weedkiller to control the aerial growth of *S. asiatica* on maize, repeated as necessary to control the regrowth. This led to the need for wider spacing of the crop, coupled with specially adapted machines in order to get through a maize crop of six weeks and older. Some increase of crop from unreplicated trials was claimed in 1950, and the complete absence of seeding would certainly manifest itself in an increased yield from the next maize crop. The other method has been developed in the Sudan, following the discovery by Andrews and Wilson Jones[12] that the *Striga* seedlings can be killed by applications of hormone weedkiller to the soil. In 1947, an application of sodium MCPA made shortly after sowing a sorghum crop, gave a significant increase in the yield of straw. Further experiments[13] have now established that the optimum control is in fact given by about 1 lb. per acre of either sodium 2:4-D or MCP, applied two weeks after sowing; the later the spraying takes place the poorer the degree of control. It should be emphasised that this latter method is one of control at the critical time only and not of eradication, for the appearance of the *Striga* is merely delayed as a result of killing the first flush of seedlings and of delaying the germination of the remainder until the herbicide is leached from or broken down in the soil. None the less, this method has brought about increases in yield ranging up to 250% on heavily infested soils, in the first year of treatment; which places the method within the reach of the native cultivator. It is very probable that a combination of the two methods would give, for the first time, a method of eradication of *Striga* which would pay for itself each year as it progressed.

REFERENCES

1. Fuller, C.: 'Rovi-Bloem or Witchweed,' First Rep. Govt. Ent. Natal, 1899-1900 (1900).
2. Pearson, H. H. W.: 'The Problem of the Witchweed,' Dept. Agric. Un. S.A. Sci. Bull. 40 (1923).
3. Saunders, A. R.: 'Studies in Phanerogamic Parasitism,' Dept. Agric. Un. S.A. Sci. Bull 128 (1933).
4. Rose, M. F., and Lochrie, J. V.: 'Witchweed,' Emp. Cotton Growing Corp. Progress Report 1939-40 (1941).
5. Andrews, F. W.: 'The Parasitism of Striga Hermonthecа Benth on Leguminous Plants,' *Ann. App. Biol.*, **34**, 2 (1947).
6. Quintinilha, H.: Private communication.
7. Andrews, F. W.: 'The Parasitism of Striga Hermonthecа on Sorghum ssp. under Irrigation,' *Ann. App. Biol.*, **32**, 3 (1945).
8. Doughty, L. R.: 'A Note on Striga Investigations in Amani,' *East Africa Agric. Jour.*, **8**, 1 (1942).
9. Watt, R. D.: 'The Destruction of Witchweed or Rovi-Bloem by Chemical Means,' *Transv. Agric. Jour.*, 7 (1909).
10. Timson, S. D.: 'Witchweed, Progress Report and a Warning,' *S. Rhodesia Agric. Jour.*, 28 (1931).
11. Martin, G. C.: 'Witchweed Control by Spray Methods,' *Rhodesia Tobacco Jour.* (1951).
12. Andrews, F. W., and Wilson Jones, K.: Ann. Rep. Res. Division, Dept. of Agric. and Forests, Sudan Govt., 1947-48 (1948).
13. Wilson Jones, K.: 'Three Experiments in Witchweed Control,' *Emp. Jour. Exp. Agric.*, **20**, 78 (1952). Also in press.

Safflower Growing in Israel

THE paint industry of Israel, faced with a severe shortage of raw materials due to lack of hard currency, has recently promoted a large-scale attempt to determine the suitability of safflowers to various climatic zones in Israel, when sown at various dates and rates.

The features making this crop attractive to farmers are:

(1) Sowing in January-March and harvesting in July-August, both out-of-season operations, permits fuller use of available machinery.

(2) The alternative exploitation of lands originally scheduled for cultivation of winter cereals (sown in early winter only) where these crops could not be sown in full at the proper time.

(3) The drought resistance of safflowers and their adaptability to very widely varying soil conditions, including the highly calcareous soils of the Jordan Valley and the loess soils of the Negeb desert region.

(4) The 'burglar-proof' qualities of this spiny crop which is used only industrially; this is an important point where extensive areas of sunflowers, maize, etc., are annually robbed by marauders crossing the borders at night.

The seed used was of Syrian origin and was not homogeneous, showing considerable morphological variation. The oil content varied from 25% to 30%.

Almost 4,000 hectares were sown in about 30 localities all over the country. Seed was drilled in rows 30 to 100 cm. apart at rates of 10-30 kg. per hectare. The crop was harvested by combine.

Numerous pests attacked the crop at all stages. The larvae of a species of *Heliothis* caused extensive damage to the soft buds. Two species of weevils and several kinds of flies infested the capituli as they approached maturity, and destroyed up to 20% of the seeds. Aeroplane spraying trials were carried out with at least partial success when applications were timed properly. Rust was ubiquitous but did not cause major damage. No root diseases of any importance were observed anywhere.

Yields were satisfactory, mainly in Western Galilee and the Mount Tabor region where rainfall amounted to 450-600 mm. Here 600-1,000 kg. seed per hectare were obtained. In the arid regions yields were usually much lower. This was largely due to the fact that proper attention was not paid to the conservation of the scanty rainfall available, which necessitates sowing early in the rainy season, careful soil preparation and weed control. Neglect of these aspects, together with the attack of Heliothis, in some cases led to total crop failures.

In the Jordan Valley vegetative development was good, but a spell of hot, dry winds in early May seriously damaged the flowers and reduced yield to a low level.

Considerable amounts of seed were lost by late harvesting and by difficulties in adapting combines to the special conditions of the safflower crop.

With the continued organised support of the paint industry larger areas are expected to be sown in 1953. Special attention will be paid to the testing of improved varieties, adequate soil preparation, evaluation of the damage caused by pests, and to suitable timing and techniques of harvesting. In addition to safflower, linseed will also be grown on fairly large areas.

J. PALTI AND F. NIZANI

Molybdenum on New Zealand Pastures

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The attention of farmers the world over is being increasingly drawn to the importance of molybdenum as a plant nutrient. In New Zealand, in particular, the question is arousing a large amount of interest. The position in this regard is discussed below by Professor T. W. Walker.

MOLYBDENUM is the latest substance to be added to the list of elements which are essential for plant growth, and in New Zealand it is likely to be the most important amongst all the trace-elements, *e.g.* iron, manganese, copper, zinc, boron and molybdenum. The New Zealand farmer is, in fact, probably more trace-element conscious than his counterpart in many other countries because remarkable results have been achieved in certain areas from dressings of cobalt salts. Cobalt is an element needed particularly by sheep and has no effect at all on plant growth; the effect of cobalt dressings on cobalt-deficient soils of New Zealand is, in fact, noticed in the health of the stock and not in better pasture growth.

The influence of molybdenum

It was Dr. E. B. Davies,[1] of the New Zealand Department of Agriculture, who first showed that the symptoms of whiptail in cauliflowers and broccoli (well known in Great Britain) were due to molybdenum deficiency in soils and could be cured by small dressings of sodium molybdate. The importance of molybdenum for certain micro-organisms, including the nodule bacteria of legumes, had been demonstrated earlier. Australian workers had shown in 1942 that molybdenum had marked effects on subterranean clover, and it was a perfectly logical step to initiate trials with molybdenum on New Zealand pastures and particularly to assess its effect on the growth of clovers. It is no over-statement to say that clovers are the pillar of New Zealand agriculture. Under the present system of pastoral farming, with a climate that favours all-the-year round grazing, and long growing periods for grasses and legumes, clovers supply almost the whole of the nitrogen needed. Sulphate of ammonia costs nearly £40 a ton on the farm, but even if it were much cheaper, probably its only value would be on the more intensive arable farms, in horticulture, for grass-seed production and for out-of-season grazing, particularly on swards containing H.1 ryegrass. Any factor, therefore, that may lead to better establishment and growth of legumes is of vital interest to New Zealand farmers and research workers.

New Zealand pastures

Apart from the breeding of better strains of clovers particularly suited to New Zealand conditions, the main factors responsible for the high production of the pastures have been dressings of lime and superphosphate. They have given vast improvements in pastures up and down the country, and when the New Zealand farmer talks about top-dressing, he refers solely to the spreading of lime or phosphate on his grassland. More recently potash has been important in improving certain areas, and recent trials show that sulphur may also be needed on some soils. It seems likely from many trials put down by Dr. Davies and his colleagues, and by other workers (particularly those connected with commercial firms), that molybdenum will become as important to New Zealand agriculture, on some soils, as lime and phosphate.

In recent articles, Davies *et al.*[2] and Lobb[3] have described some of these trials, and at a recent conference of the New Zealand Grassland Association papers were read by various others workers. Some of the effects of sodium molybdate applications which have been seen by the writer can only be described as 'phenomenal.' On one grass-clover sward containing a control plot side by side with a plot sprayed with sodium molybdate at the rate of 2½ oz. per acre, the operator must have walked across the control plot, his boots being wet with the spray. The trail of footprints stands out as clearly as the track of a prehistoric reptile preserved for posterity in some geological strata—dark green outlines against a stunted, yellowish-green background. The outstanding effect is on legumes and the grasses benefit when the nitrogen contained in the legumes is excreted by the grazing animal; sometimes there is also a direct effect on the grasses and responses have been noted on rape, cereals and on other legumes, particularly lucerne.

Small amounts of molybdenum needed

The point which interests farmers greatly is the very small amount of molybdenum needed to give, on some soils at least, a very large increase in yield. Trials are under way to discover the optimum dressing of sodium molybdate (one of the most

In the control plot, just in front of the horses, the red clover is poor. The dark red clover, however, has been plot treated with 2½ oz. acre of sodium molybdate

suitable forms in which to apply molybdenum). The amount may vary from soil to soil, but in some cases as little as one-eighth of an ounce per acre is having big effects. The difficulty of applying such a small quantity is being met by the fertiliser manufacturers putting a ' molybdenised ' superphosphate on the market, a small quantity of sodium molybdate being mixed with phosphate. It can, of course, be sprayed on to the field. Not all soils respond to treatment and on some soils smaller increases in yield are obtained. An interesting case of improvement by molybdenum on the Lincoln College Farm may have wider repercussions. A considerable amount of lucerne is grown in Canterbury, and usually it is cut for hay three or four times a year. When lucerne stands begin to deteriorate the fields are often ploughed up for one or two arable crops and sown down again to lucerne. Often it is difficult to get good establishment and growth at the second sowing and this trouble was experienced on the College farm. A trial put down, with sodium molybdate as one treatment among others, showed a much better early establishment and a 30% increase in yield in the first harvest year.

Molybdenum and lime

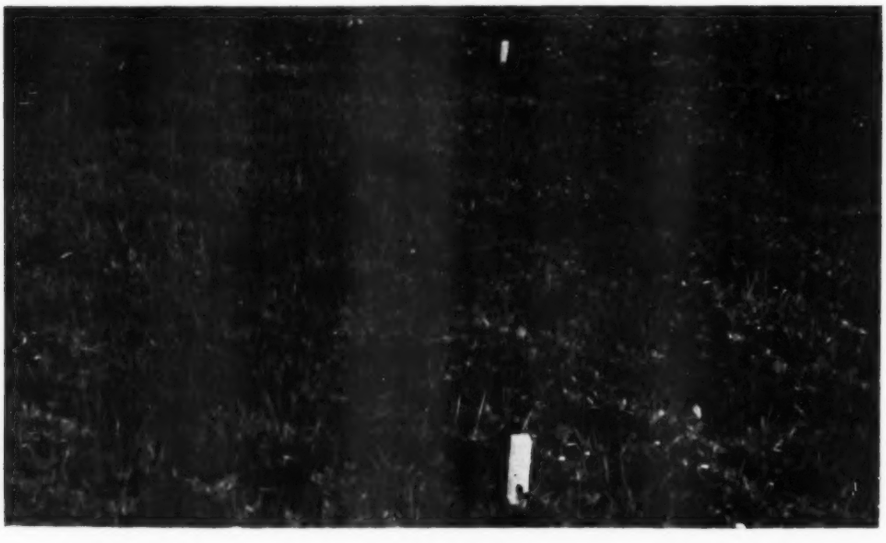
One of the most important points emerging from these trials is the marked interaction of lime and molybdenum; on some soils which are normally considered to need liming and on which clovers respond well to applications of lime, an ounce or two of sodium molybdate has given effects similar to those given by dressings of one or more tons of limestone per acre. One of the main effects of liming on some soils may be to make molybdenum more available. This suggestion raises many interesting questions, some of which will be considered below, but in New Zealand it has given hope of improving some of the inaccessible high country grazings. In many areas it is difficult or impossible to apply lime except from the air, and the cost of such dressings can be prohibitive. It has been considered that generally liming is necessary before using phosphate and over-sowing with clovers and better grasses, but some aerial top-dressing firms are now busy spreading molybdenised superphosphate and are not using lime at all. Without waiting for the results of experiments this is risky, but some of the areas so treated, which have been seen by the writer, appear to justify the risk, although in the absence of areas treated with phosphate alone it is not possible to say how much of the benefit is due to molybdenum and how much to phosphate.

These trials have stimulated great interest in New Zealand, and it is amusing to hear the average farmer trying to wrap his tongue about the word ' molybdenum.' It is not so amusing for the lime companies, some of whom are beginning to wonder if their sales of lime will be affected if research and field trials confirm that on many soils lime need not be applied if a small amount of molybdenum is used.

Some practical and academic questions

Some practical and academic questions are worth considering here. For a long time soil scientists have been interested in just what happens when a soil is limed. On very acid soils lime is definitely needed to supply calcium as a plant nutrient in exactly the same way as phosphate dressings are needed on phosphate-deficient soils, but a few cwt. of lime to the acre should be enough for that purpose. It is known that on very acid soils aluminium and manganese may become so soluble as to be toxic to some plants; liming at fairly heavy rates raises the soil *p*H and renders the aluminium and manganese less soluble and therefore less toxic. Certain soil micro-organisms, such as the bacteria which produce nitrate, thrive best on adequately limed soils; phosphate is often most readily available to plants on slightly acid soils and is more easily lost by ' fixation ' on the more acid soils. Larger soil organisms such as worms are encouraged by liming acid soils, and there may be effects from lime on soil structure. Some or all of these factors could be responsible for the improvements caused by liming, the effect of lime in making molybdenum more available to plants and micro-organisms must now be added to the list. Molybdenum deficiency is not, of course, confined solely to acid soils, even some well-limed soils have responded to molybdenum in New Zealand. It is not expected that all acid soils will be found to be deficient in molybdenum, nor that liming will make molybdenum more available on all acid soils—no amount of liming can make more molybdenum available if it is not there initially in an unavailable form.

If one of the main effects of liming is to make molybdenum more available, and if small amounts of molybdenum will give the same results on many soils as heavier dressings of lime, we must ask how far the omission of liming affects all the other factors mentioned. Would a small amount of molybdenum on an acid soil allow us to recover as much phosphate as if the soil had been limed ? Is so-called phosphate ' fixation ' on acid soils due as much to the unavailability of the molybdenum as to the acid conditions ? On soils where the effects of acidity are due largely to toxic manganese or aluminium, it is difficult to see how molybdenum can replace lime. The pedologist interested in soil-forming processes may ask: What of the earthworms if soils can be made more productive for crops without correcting acidity ? Will worms thrive in acid soils treated with molybdenum, or will they remain inactive, leaving the extra organic matter returned to the soil by the better plant growth accumulating on the surface ? Some of these questions, and others, are being considered in New Zealand. Until they have



The control plot of pasture is on the left. **The plot on the right has been treated with sodium molybdate**

The left hand side of this pasture has been treated with sodium molybdate and super; in the centre with super only and the right with sodium molybdate only

been answered, no one should be so unwise as to advise farmers that they can drop liming in favour of minute dressings of molybdenum at a considerable saving in labour and cost. Some soils will always need lime, but molybdenum may obviate the heavy dressings sometimes recommended.

Molybdenum and livestock

Another point which has caused concern, particularly to the veterinarian, is the possible effect of molybdenum dressings on stock. The 'teart' pastures on the Lias Clay of England are well known. Scouring troubles in stock are caused in those areas by excess molybdenum in naturally-calcareous soils. High soil molybdenum may cause low copper availability to stock and on copper-deficient soils in New Zealand there has been concern that molybdenum dressings may enhance the possibility of copper deficiency. This is not likely to happen unless some farmer, seeing wonderful effects from an ounce or so of sodium molybdate, decides to see what one or two cwt. would do!

The recent discovery of the practical importance of molybdenum as a plant nutrient may explain some problems which are not fully understood at present. Basic slag is renowned for its effect on the clovers in pastures; superphosphate and lime may give the same results on acid soils, but it is possible that some of the benefit from slag may be due to its small content of molybdenum. A dressing of farmyard manure on acid soils often gives a better crop; this effect could be due to molybdenum contained in the manure. In New Zealand there is one limestone, not of high quality judged by its lime content, which has been selected by farmers because it had outstanding effects on pastures as compared with other limestones of higher quality. This material has been found to contain a few parts per million of molybdenum. Molybdenum deficiency is severe in some parts of Australia, and peas and beans may do poorly on certain soils if home-grown seed is used. Seed imported from other areas gives good crops and recent work has shown that peas and beans grown on non-deficient soils store enough molybdenum to carry them through their complete growth cycle when sown on deficient soils.

Conclusions

This article has been written with the hope that it will stimulate some interest in the subject in other countries. There is little doubt that on some soils, at least, molybdenum will have as profound an effect as in New Zealand. Responses to molybdenum have been obtained on a wide range of different soil series scattered through the whole of the north and south islands of New Zealand, both in wet and dry and in warm and cool areas. The responses are not always related to the acidity of the soils. The unimproved hill- and high-country soils in New Zealand are not generally as acid or poorly drained and peaty as the hill areas in north-western Europe; therefore, responses to molybdenum without liming and drainage are more likely in New Zealand than in Europe. In all countries where grass/clover swards, lucerne and lucerne/grass mixtures are important, it may pay to start trials with molybdenum, particularly in areas where it is difficult to establish and maintain clovers, or where whip-tail occurs in cauliflower and broccoli crops. In Britain, molybdenum may be worth a trial in the south-west, in Wales, the Welsh border country, the Pennine region and in Scotland. Possibly in countries where acid soils have already been well-limed fewer areas will be found to respond to molybdenum. Research is already in progress to establish levels of 'available' molybdenum in the soil which may lead to crop-deficiencies, but at present the best way of finding out whether a given soil is deficient in molybdenum is to carry out a trial, using not more than two or three ounces of sodium molybdenate per acre. A strip through a pasture, a hay crop or a field of lucerne should generally show up in a very short time; legumes have become a darker green a few days after a dressing of molybdate in some of the New Zealand trials.

It has been said that molybdenum will prove to be the most important aid to higher production in New Zealand which has been discovered since the time when the value of phosphate was first established. This remains to be proved, but there is no doubt that it will have profound effects. Molybdenum may not prove to be so important in other countries, but it will be very surprising indeed if this trace-element does not give marked benefits in some areas.

REFERENCES

1. Davies, E. B.: *Nature*, **156**, 392 (1945).
2. Davies, E. B., Holmes, G. A., and Lynch, P. B.: 'Pasture Responses to Molybdenum Top-dressing in Otago and Southland,' *N.Z. Jour. Agric.*, **83**, 274 (1951).
3. Lobb, W. R.: 'Molybdenum Investigations in North Otago,' *N.Z. Jour. Agric.*, **84**, 356 (1952).

Technical News

In the July issue of **Food Manufacture** there are articles on the 'Action of Vitamins' and 'Pressure Cooking and Cooling.' Also in this issue is a description of the factory of Canned Products Ltd.

Chemical and Process Engineering for July includes a 'Review of Evaporation' by Dr. J. M. Coulson.

T. L. Forsyth, B.Sc., writes on 'Particle Size—Its Measurement and Importance in the Chemical Industry' in the July issue of **Manufacturing Chemist.** Other articles in this issue include 'Chemotherapy and Selective Toxicity,' by Dr. T. L. Stoves; 'The Vitamins,' by F. A. Robinson; and 'Terramycin Production in England.'

Muck Shifter for July includes an article on 'The Place of Cranes in Muck Shifting.' In addition, John Grindrod writes about the earthmoving feats introduced in the Kitimet Aluminium Project.

Education in Tropical Agriculture

C. W. L. FISHLOCK, B.Sc., A.I.C.T.A.

Former Senior Agricultural Officer (Education), Uganda, and Dean of the School of Agriculture, Makerere College

The rapidly changing aspects of the agricultural scene in British tropical dependencies is a source of concern to all interested in administration in the under-developed territories. In attempts to guide development along sound and safe lines, agricultural education plays a leading part. In this article, Mr. Fishlock, who was for many years connected with agricultural educational efforts in East Africa, discusses the history and implications of the present position.

THAT education will not fill an empty belly unless it can induce the present and coming generations to understand the economic consequences of bad farming and soil deterioration, was a trite criticism of a recent report on general education in Africa. This is apposite to the tropics generally and no one with a knowledge of agriculture under tropical conditions is likely to disagree. The steady growth of native populations and the ever-increasing demands upon tropical soils for food and other necessities, make it imperative to bring home to peoples in the tropics the urgent need for improved farming and the better use of their soil. In most tropical countries agricultural education is beset by a number of economic and social problems from which general education has been largely free, and those concerned with this aspect have often been discouraged and disillusioned by an apparent lack of success. Even in the United Kingdom, it was a slow and, for a long time, a discouraging pursuit. Its importance was never in doubt, however, and means were found at the height of the last war to enquire into all aspects of agricultural education in England and Wales and as far as possible provide for its advancement. To this end at least two learned committees were appointed and action taken on their findings.

Students receiving instruction in the use of drill sowing equipment at the Agricultural School, Samaru, Nigeria

Definition of agricultural education

In the report of one of the English committees, agricultural education was defined as the training and instruction of those at school and those who have left school, of both sexes, in the sciences in their application to agriculture and in the art and practice of cultivating the land for the production of crops. It included also training in livestock, poultry and dairy husbandry, horticulture, the various manual processes connected with the art and craft of farming, the care and use of agricultural implements and machinery, the establishment of advisory services, the provision of lectures and demonstrations, and the establishment of discussion groups and clubs. In the case of children still at school, the object should be not to turn out semi-skilled farmers or farm workers at the school-leaving age, but to fit those who in future will hold responsible posts in the farming industry to become intelligent, useful and happy members of the rural community. These aims and objects apply equally to agricultural education in the tropics, but neither the local knowledge nor the local personnel necessary for teaching on this basis have been available in the past. It is to be hoped that no time will be lost in acquiring the necessary knowledge and applying it through suitably trained teachers, in tropical countries.

Organisation and development

The establishment of the Imperial Department of Agriculture in the West Indies early in this century may be claimed to have been the first organised attempt at agricultural education in British tropical dependencies. From this, the Imperial College of Tropical Agriculture was ultimately evolved which is concerned solely with agricultural education and research. Its students are drawn from almost all parts of the world and its products, both human and scientific, go out to every corner of the tropical world. The Imperial College of Tropical Agriculture may be said to be the apex of an agricultural education pyramid whose base covers the colonial territories. In a descending order are now the newer universities and colleges and similar educational institutions at which, in addition to other subjects, courses in agriculture are provided. In addition, certain institutions exist which are purely vocational in nature, such as the agricultural training centres and schools maintained by many colonial departments of agriculture for the practical instruction of native field instructors, demonstrators, school teachers, chiefs and local culti-

vators. In such schemes, provision must also be included for the training not only of agricultural instructors and demonstrators, but increasingly also for the training of men of the highest integrity, initiative and ability to fill higher and more responsible posts in the agricultural service of the territories. The great value to a territory of men of this type was clearly shown during the last war. In parts of Africa, they were able to replace European officers who had been called to the fighting services, or they augmented the European staff and helped not only to maintain but materially to increase native agricultural production. In this way, native agricultural systems, in many instances, emerged strengthened and improved from the war-time and immediate post-war strain of greatly increased production. It is unfortunate that the relatively small cadre of African agricultural assistants has not expanded as quickly as expected. This has been due to a variety of factors, among which can be included the relatively small numbers of boys coming from the secondary schools with a sufficiently high standard of general education for an advanced training in agriculture, and the great attraction a training in medical science has exercised upon those with the necessary educational qualifications.

Tropical departments of agriculture early appreciated the necessity for providing elementary training in agriculture and the natural sciences underlying it for school teachers. It has always been obvious that the majority of children in the schools in tropical countries must, of necessity, return to the land for their living. In the early days, the duties of the departments of agriculture often included the teaching of botany, chemistry and similar subjects ancillary to agriculture in the local schools. Gradually, however, such teaching, and also that of agriculture itself, came to devolve on school teachers who received instruction in their training. In some countries, it is now impossible for a teacher to be fully qualified without a certificate obtained at an approved agricultural training centre. The benefit derived from the teaching of agriculture in schools in this way is considerable and is not altogether fully appreciated.

The conception of a formalised school garden in which to demonstrate such practices as manuring, correct spacing of each variety of crop and the rotation of crops, in early days was widely adopted as part of the agricultural education provided, but the practice in the elementary schools later fell into disfavour largely because native teachers came to regard school gardens as a means of obtaining cheap labour for

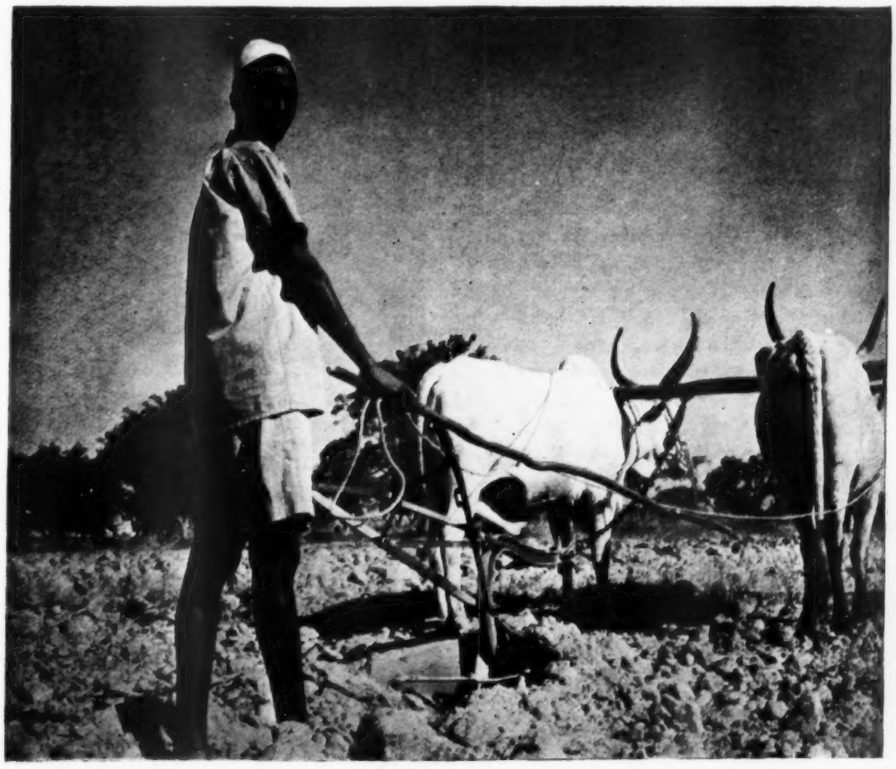
Students examining a cotton flower in Nigeria

raising food crops for their own consumption. At teacher-training centres, small demonstration-farms, and in the elementary schools the flower garden has latterly tended to replace the formal school garden. The effective teaching of practical agriculture in schools and teacher-training centres still presents many and great difficulties to overcome which requires careful thought and research.

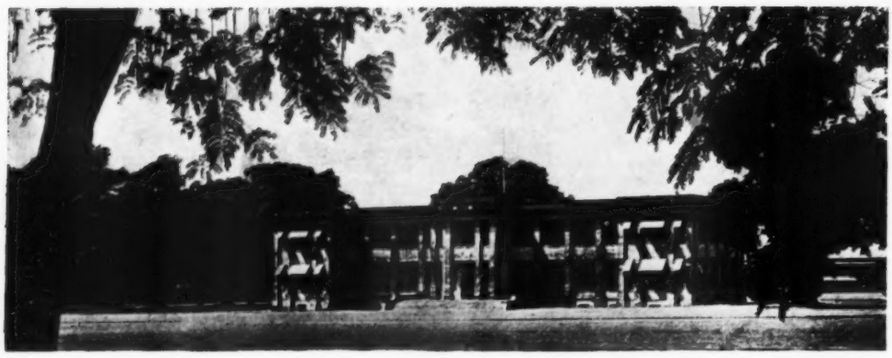
Smallholdings

To overcome the difficulty of providing effective training in practical agriculture in the schools, it was proposed in certain territories that training for boys leaving school might suitably be provided on smallholdings. Theoretically, this conception has a great deal in its favour, but experience showed that if such training is intended, as was the case in most instances, to enable pupils eventually to establish themselves on self-contained smallholdings it usually fails in its object. This almost invariably was due to lack of sufficient capital by the young smallholder to provide for his own keep and at the same time to stock and develop his small farm.

In different countries, other factors, such as local custom and land usage and suspicion of a self-contained farming unit were also responsible for the lack of success. The alternative is being tried, in some countries, of bringing adult men and their womenfolk from their homes to training centres where simple training in and demonstration of improved agricultural practices are provided. Because such cultivators are generally illiterate and incapable of assimilating in a short time any great amount of knowledge, and as



The use of the ox plough, the main hope of Nigerian agricultural development, is being taught at Samaru



The Imperial College of Tropical Agriculture at St. Augustine's in Trinidad

they naturally do not wish to be away from their homes for any great length of time, only one or two simple practices for improved agriculture are demonstrated. The principal advantage of such a course is that it enables cultivators to get to know their teachers and appreciate the mutual benefit to be derived from closer co-operation with them. A corollary to this is provision to enable the leaders of agricultural and rural communities to be won over to improved methods of farming. In Africa, many chiefs are farmers on a considerable scale, not only for the production of economic crops, but also to provide food and drink for their retainers and followers. It is easy to appreciate how widespread can be the effect of the adoption by such chiefs of improved methods of agriculture.

A lecture on yam growing at the Kumasi Agricultural Training Centre in the Gold Coast

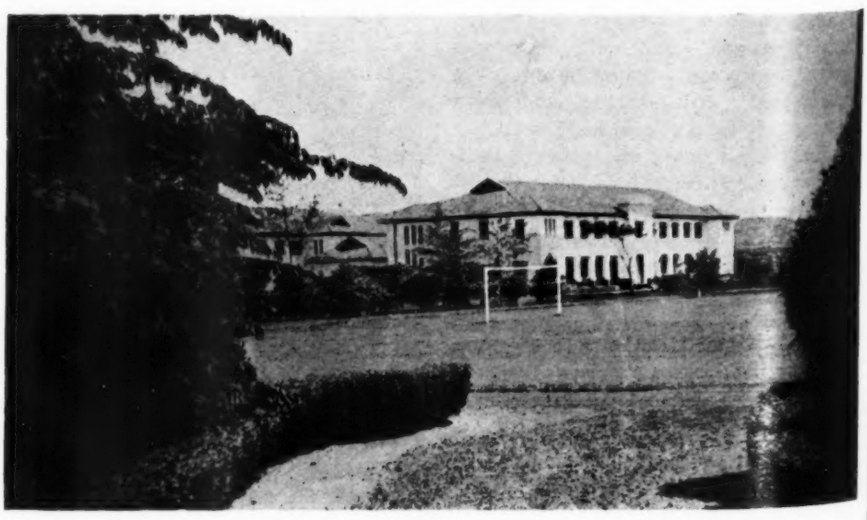
Centres of agricultural education

The part played by the Imperial College of Tropical Agriculture has already been mentioned. In the larger territories, university colleges have been established in the last 20 years and, in the majority of cases, are making rapid growth. They generally include faculties or schools of agriculture and award diplomas in agriculture. The acceptance of these diplomas, at present, is likely to be limited to the particular territory in which they are awarded, but it is hoped that eventually they will become acceptable outside their present territorial limits. The ultimate object of the present colleges is naturally the attainment of university status and the granting of degrees in agriculture and related subjects. It is to be hoped, however, that the authorities concerned appreciate the importance of *festina lente* in these matters.

The future

The future of education in tropical agriculture is bound up with appreciation of the development of agricultural practices and native customs. Not least among the problems are those of sociological groups. Local knowledge and experience are the basis of existing agricultural systems and they have been won through generations of bitter experience of crop and livestock losses due to droughts and epidemics. It is only natural, therefore, that native peoples should be conservative in their attitude to change in their agricultural customs, and it is imperative therefore to demonstrate that any proposed change is definitely superior to existing native practices. Apart from innate conservatism, there is often great lack of faith in the future, largely based upon the formerly ever-present fear that as a result of *e.g.* inter-tribal raiding, the fruits of their labours would be lost. Confidence in settled administration is slowly coming into being, and a similar confidence is developing in the practical value of new systems of agriculture.

The old order was evolved very largely upon a community basis and for continuity the new order must also be built on a community basis. In many places, the practical value of the co-operative movement has gained appreciation and good progress has been made in co-operative trading. The application of the co-operative technique to practical farming appears likely to succeed where group or community farming can be brought into being. The difficulty in providing the capital for the development of community farming in under-developed countries in the tropics is a great handicap. The task of bringing about the revolution in native agricultural practice which will enable such communities to survive on a basis of greater stability is one of almost insuperable magnitude. If it is to be successfully accomplished, it must be through education and persuasion. The lessons and mistakes of the past serve as guides and landmarks, and new knowledge is constantly accumulating as the result of research and experience; if all these factors can be woven into a coherent and connected pattern of development, there is hope for the future.



College of Agriculture, Serdang, Malaya

Agricultural Problems of the Niger Delta

C. H. BROWN, B.Sc.

In WORLD CROPS, *Vol. 3, p. 167, we were privileged to publish a paper by Monsieur Maurice Rossin on the great French scheme for the development of the Upper Niger Delta at Sansanding. This region has recently been visited by Mr. C. H. Brown, the eminent authority on cotton breeding in Egypt and well known to our readers as the author of a number of papers in* WORLD CROPS. *In this paper, Mr. Brown reviews the present position and prospects for this great project in the light of his knowledge of similar conditions elsewhere.*

THE irrigation and cultivation of the Niger Delta region is one of the major agricultural projects at present being worked out in Africa. In French official circles there has perhaps recently been a growing note of caution in their attitude to the scheme, but it should be made clear that this is in no sense indicative of a desire to go back on plans already decided on. The psychological effect of our own groundnut fiasco has necessarily had very wide repercussions in the minds of all reponsible for agriculture in Africa. It is right that this should be so for all human progress is based on learning from the mistakes that have gone before, whether our own or other people's. By general consent, one of the big defects of the groundnut scheme was to try to push ahead too quickly. Africa's natural pace was not perhaps entirely forgotten, but it was hurried by directives from Europe, intended to remedy Europe's urgent need for oil. That the hurrying of Africa is not quite so easily accomplished is a lesson worth learning, and if it is taken to heart everywhere else as much as it has been in France, the British taxpayers' money will not have been spent entirely in vain. French financial difficulties have also played a role in the decision to retard the pace of the development of the project. As a result, the present cultivated areas are now regarded as frankly experimental, as a sort of intermediate stage between research and full commercial exploitation.

The dam at Sansanding

The present position

All these factors considered, I think that the present speed of development entirely fits the needs of the situation. The excellent barrage at Sansanding is in full working order, and about 40,000 acres of irrigated crops are at present being grown. This achievement must be contrasted with the estimated target of 2 million acres of irrigable land when the scheme is completed. Of the existing 40,000 acres of crops, about 35,000 are in rice and 5,000 in American type cotton, with an annual extension for each of these crops of about 2,000 acres. Egyptian type cotton, to which I shall return later, is just beginning to be grown.

What, more precisely, are the unknowns ? They are first, the big decisions which had to be made *à priori*, the first and most important being to separate rice districts from cotton districts. There does not appear to be any particularly valid reason for this. In Egypt, for example, in the North Delta, the alternation of rice and cotton in the same rotation is entirely acceptable and commonly practised. I have heard it stated that in the Niger irrigation for rice is suspected of producing a pan which would be deleterious to cotton, but Egyptian experience does not appear to bear this out. The really basic reason in the Niger has, I think, been the desire to economise, as far as possible, on the costly major canalisation, by laying out each block with canals specially adapted to the irrigation needs of the crop being grown. I am not entirely sure how far this question is regarded as having been settled once for all. Recently, apparently, it has become appreciated that the irrigation facilities required for these two main crops are not necessarily so different as had at first been thought.

Rice cultivation problems

For the moment, anyway, whatever may be decided for the future, there are rice blocks and cotton blocks, and since the rice started first and has progressed furthest it is fair to discuss it first. I claim no special knowledge of rice growing, and so can only give here the few facts that I have gleaned on the spot. First, the rice blocks will be grown continually in rice, the whole set up of the area being for a crop of rice and nothing else. No difficulty seems to be experienced in the

adaptation of a normally millet eating population to a rice diet, and it is hoped that as the acreage increases the Niger crop will make an important contribution in replacing at least some of the present rice imports of French West Africa. The world shortage of rice, or at least of rice crops available for sale, seems destined to continue; rice prices have dropped in the last year or so much less than those of many other crops, and it may even be that a world rice shortage has come to stay permanently.

The main problem of the N ger region is therefore to raise the average rice crop to the maximum. As the pace of irrigated development has outrun that of the settlement of new colonists, it was decided to experiment with fully mechanised rice growing, and about a quarter of the total rice area is at present cultivated mechanically. This sort of agriculture naturally poses its own specialised problems. We may remind ourselves that the groundnuts of East Africa were intended to be mechanically cultivated and that it was in the choice and maintenance of the implements that some of the greatest difficulties were encountered and the estimates went most badly astray.

Rice harvest in the Niger Delta

Combine harvester

For rice, the combine harvester is the most specialised machine, and therefore needs the closest special study. Ploughs and seeders are after all more generalised machines whose exact capacities have been fully investigated on other crops. For combines, which are complicated machines anyway, it is the possibilities of maintenance by local personnel which is the most important of the technical merits of this or that machine. In the crop recently harvested (the growing season is June to December) the McCormick, Massey-Harris, Case and Bubba combines have all been under study. Average crops of the order of a ton of paddy per acre have been reaped. This corresponds fairly closely to the general world average of rice-growing areas, although more successful countries realise appreciably higher averages; higher returns can, however, be obtained in the better parts of the Niger area.

Cotton problems

Another major *à priori* decision was to divide the cotton-growing zones into two areas: for American Upland and Egyptian type cotton respectively. Rainfall in the whole region shades off gradually from south to north; the southern part of the French Sudan (as the whole district is called) is contiguous with the heavy rainfall area of French Guinea where the Niger has its origin. By contrast, the northern parts, west of Timbuctoo, shade gradually off into the desert of the Sahara. Here, 20 years or more ago, a small crop of Maarad cotton was grown, by pump irrigation, in the district of Diré, the staple of which was favourably commented on by English spinners. Under Sudan conditions, and here the French Sudan closely resembles the Anglo-Egyptian Sudan, the cotton-growing season is from July to March, with the year's rainfall hitting the crop at, or soon after, sowing time. These conditions favour the development of the bacterial disease known as blackarm (*Xanthamoras malvaceum*), and it is the heavy blackarm attack which rules out Egyptian cotton as a serious possibility in the more southerly parts of the Niger Delta. The strains at present grown there are local selections of the Allen variety, a type widespread throughout the whole of West Africa. Its success here is in striking contrast to the fact that it has now been completely eliminated in the United States cotton belt. On the other hand, the newer highly bred Upland varieties of the U.S.A. do not appear, on the whole, to do well in West Africa, so that one may say that a separate West African Upland type is now being evolved. There has been considerable crossing with the sub-species *Caribphum punctatum*, and this Allen cotton now seems to carry a high degree of resistance to various maladies to which the modern American Upland cottons are susceptible.

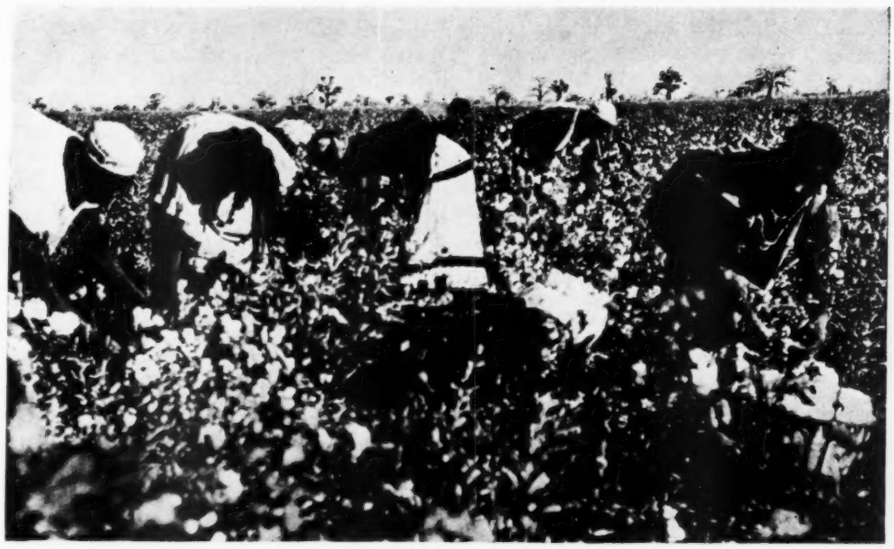
Bush clearing in the Niger Delta

Cotton rotations

A farm year rotation of cotton, millet, cotton and fallow is another *á priori* decision. It has aroused some theoretical misgivings, because it is twice he cotton density of the famous Gezira rotation of the Anglo-Egyptian Sudan. I do not think anyone really knows for certain whether it will prove possible to continue permanently with a rotation of 50% cotton, although Egyptian soils seem able to maintain this cotton density. The point may finally depend on keeping up soil fertility with suitable manuring. At present, with new land coming into cotton cultivation each year, no great urgency has been felt about the manuring question. Researches have, however, been started which indicate that the crop does respond well to the usual manurial applications, including a dressing of limestone on some of the more acid soils. The best manure and the appropriate economic dosage will, probably, have been decided by the time the soil shows a real need. There appear to be workable deposits of calcium phosphate near Timbuctoo which will come in useful when there are large cropped areas. The heavy cost of development in the Niger Delta, far from ports, makes it urgent to exploit the soil at the most intensive cropping rate possible, whatever that rate finally proves to be. Average yields of cotton in the Upland tract appear to run to about 300 lb. of lint per acre. But again appreciably better averages could be obtained if the poorer patches could be brought to the level of the better.

Irrigation frequency for cotton

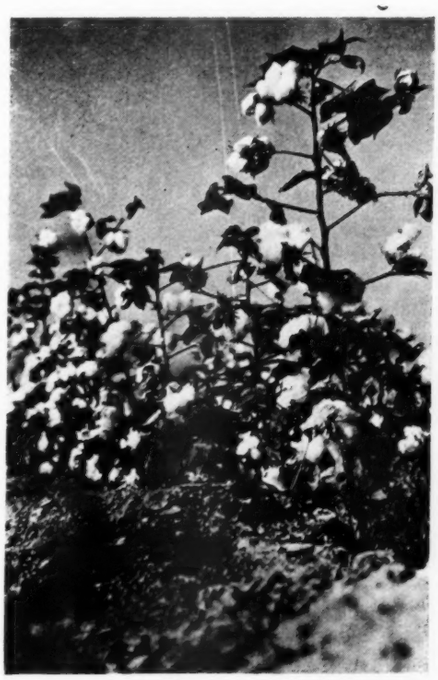
The poorer patches, in the cotton zones, may be due to poor, generally sandy, acid soils, but an even more considerable problem is the regularity of irrigation. The whole district is flat, but once irrigation has started, small-scale differences of level soon show up, and become of first importance. It is not so much that the slightly higher patches suffer from light irrigation, but much more important is the fact that the lower patches suffer from waterlogging. Moreover, the surplus accumulation of irrigation water is added to by the run-off of the heavy rainfall during the rainy season. The result is partly shown in a direct water surplus and partly in indirect effects like increased difficulty in weeding; in addition, at least in the Egyptian cotton areas, blackarm infestation is encouraged. All the land in the Niger Delta is, before cropping, levelled by American land-levelling apparatus, but the lesson now being learnt, somewhat painfully, is that one levelling is not enough. A really true level for perfect irrigation will, it is now realised, be obtained only by consecutive levellings each year over a period of five or even ten years.



Picking the cotton crop

Drainage requirements

In addition to levelling for irrigation there is also the problem of drainage to take away the surplus water which accumulates in the rainy season anyway. Plans were made originally to allow for what was hoped would be a sufficiency of run-off, but it is now realised that both deeper, longer and better planned drains will be needed. Although these difficulties are certainly going to raise the original estimates of cost, the fruits of these efforts should be valuable. They will reduce what is at present the greatest single cause of low yields, and enable the full technical possibilities to be seen. Judging by the present good patches, these are high. There is an excellent growth of clean cotton, with a notable absence at present of serious insect pests.



Upland cotton ready for picking

Growth of Egyptian strains

In the zones in which Egyptian cottons are grown attention is being concentrated on varieties introduced from the Gezira, the L type (X1530 and its derivatives) being the one commercially grown. But the Egyptian crop in this region is only at its beginning stage with 200 acres last year and 700 acres planned for next, and little or nothing is yet known of the commercial reception of the cotton grown there. Gezira selections resistant to blackarm will check the damage done by this pest, while, in the more distant future, there seems no reason why locally-bred varieties should not prove even more suitable to the local conditions. The work of breeding, testing and multiplying the best adapted strains to local conditions, however, must take time as in fact has been seen in Egypt.

Pests and remedies

In the Egyptian zone, insect pests are not yet numerous, although some increase of *Earias*, the spring bollworm, has been noted this season. The remedy for this may be insecticide treatments, which will come in for intensive study next season. The full experience of the other French cotton research stations will be put at the

disposal of the Niger authorities, and the result can be only beneficial to both.

Conclusions

All these facts considered together indicate that in spite of the variety of technical difficulties the future of this project can be viewed with optimism. It is quite impossible to say at this stage what final average yields will be obtained from the different crops. Equally impossible, I imagine, is it to say what final total investment of capital will be required. Bold strokes of imagination like that of using the bed of the old Niger valley as a main irrigation canal may reduce costs, but I think average yields are the final criterion of all agricultural development schemes.

The indirect advantage is, of course, the provision of cultivable land for orderly development in what is at present a primitive pastoral area. The population density that can be carried by this kind of agriculture is strictly limited, and at present population in the region is sparse. The Niger irrigation scheme will assist, however, the natural increase of population, and also attract immigration from adjoining areas of French West Africa. This is being encouraged. Planned village settlements are being set up, in which tribal unity is as far as possible maintained, and the share-cropping system of the Sudan Gezira is being used as a model for development in an organised partnership between the authorities and the grower.

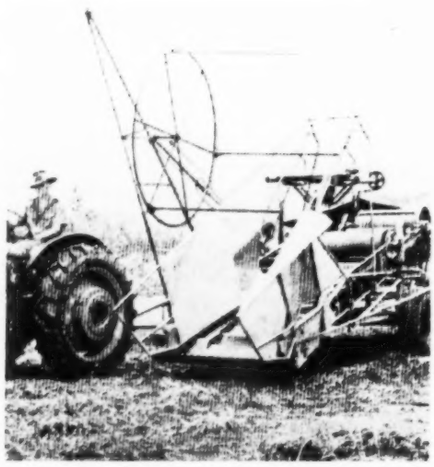
Investigations on the Production of Jute in the British Colonies

Volume IV, No. 2, of the *Colonial Plant and Animal Products Journal* contains an account of recent investigations carried out in various parts of the British Colonial Dependencies on the mechanised production of jute and jute-substitute fibres. Prior to 1948, the Colonial Office had approached a number of Colonial Governments on the possibility of producing jute and jute substitutes, and by 1948 a number of Governments were conducting growing trials.

Trials with jute

Trials with jute were carried out in British Guiana, Fiji, the Gold Coast, Kenya, Leeward Islands, Malaya, North Borneo, Nigeria, Nyasaland, Sarawak, Sierra Leone, Tanganyika and Uganda, while trials with *Urena lobata*, *Hibiscus cannabinus*, *Hibiscus sabdariffa* and some other fibres were also carried out in these and a number of other territories. Preliminary trials soon showed that the cultivation of jute would not be possible in certain territories and the experiments were accordingly discontinued. In some cases, climatic or soil conditions were found to be unsuitable, in others the available labour supply was too small to permit commercial production.

The experiments so far carried out, however, provide useful information regarding the possibility of production in the Colonies. They have shown to what extent local production would be dependent on heavy manuring; they have also shown that varieties of jute vary considerably in their requirements; while in some instances local varieties give better results than do imported Indian ones, *e.g.* in Uganda, where local varieties of jute have been grown successfully in soil which would not normally be suitable for jute growing. Moreover, at least one imported variety has been found to grow taller, to flower later, and to give higher yields than Indian jute when grown in British Guiana and the Gold Coast. It seems that previous attempts to grow jute in countries outside India may have failed, not because the soil conditions were unsuitable but because the length of day was not suitable for Indian varieties.



Reaper-ribboner used at Mokwa

In countries where preliminary trials have indicated the practicability of jute cultivation larger scale trials are in progress, but these will take time. In British Guiana, results have been particularly encouraging, while in the Gold Coast and Tanganyika the results again suggest that, provided other factors are favourable, the economic production of jute may be possible.

Samples of jute produced in Kenya, North Borneo, the Gold Coast, British Guiana, Jamaica and Tanganyika have been sent to the Colonial Products Advisory Bureau and reports have been furnished to the various governments. The tests undertaken included laboratory examinations and the evaluation of samples by a jute spinner. The quality of the fibre varied considerably, in some cases it was very short in length. Where growing conditions were favourable the chief faults were poor quality due to bad preparation and retting. Considerable work has already been carried out to ascertain whether jute production could be a commercial possibility in the Colonies, prospects are encouraging but more extended trials are required before a final answer can be given.

Trials with jute substitutes

Kenaf in Nigeria

Extensive trials were carried out with Kenaf (*Hibiscus cannabinus*) at Mokwa in Nigeria in 1950, and in 1951, as a result of planting in 1950, it was proved that it is possible to harvest *Hibiscus* and to debark the stem fibres mechanically. The difficulties of drying, handling and retting sliver as extracted from the stem indicated that it was a less efficient method of handling ribbons than stricks. It is possible, and probably economic, to handle, dry and store the ribbons in strick form. The retting of the dry ribbons or stricks can easily be performed for the production of fibre. A special reaper-ribboner was designed which gave very satisfactory results; a picture of this is reproduced.

In 1950, preliminary costings were made and it was found that the cost of running a tractor puts up the cost of operations appreciably. There might be a considerable saving in cost if the stricks could be taken from the ribboner and hung on the drying lines *in situ*. Generally speaking, the two trials confirmed that the methods suggested for dealing with a stem crop similar to jute or *Hibiscus* were sound, and that provided the crop could be grown cheaply enough it would probably be possible to harvest and produce the fibre from the ribbons at a price which would enable it to compete with fibres harvested and produced under peasant conditions.

Aldrin and Dieldrin

PART II

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This is the second of the two articles on the insecticides Aldrin and Dieldrin, the first of which appeared in the issue of WORLD CROPS *for June last. It deals with the use of Aldrin for controlling the wide range of injurious insects which inhabit the soil and describes some of the striking results which have attended its use in a number of cases.*

SINCE they were first synthesised in 1948, aldrin and dieldrin have been used extensively and have achieved a number of major successes. It would, however, be impossible in this short article to give anything but a brief reference to the many uses to which aldrin and dieldrin have been put, and a review will therefore be made of one aspect of the subject only: the use of aldrin in the soil.

The need for control of soil pests

Although the control of soil pests has hitherto not been attempted on anything like the same scale as the control of pests attacking the above-ground parts of plants, the necessity is a very real one. Roots, bulbs, corms and tubers are all subject to destruction by subterranean pests, and damage may be brought about on one or more of the following ways :—

(*a*) Direct feeding on newly planted seeds.
(*b*) Direct feeding on rootlets or root hairs.
(*c*) By boring into or severing the roots.
(*d*) By feeding on the surface of the roots.
(*e*) By attacking the underground portion of the plant stem.

In addition to the crop losses resulting directly from the above causes, damaged root systems allow access to the disease pathogens present in the soil. The root systems so attacked may result in heavy economic losses and, sometimes, in the complete loss of crop. Root crops may be down-graded due to the presence of feeding scars, tunnels or blemishes.

In addition to those insects and related organisms which feed directly on the root systems of plants, many of the pests which attack fruits, flowers or foliage spend a part of their life-cycle below ground. The destruction of such pests during the period of their existence in the soil provides a simple and safe means of using an insecticide and has the advantage of opening up the possibility of controlling both subterranean and foliage pests in a single operation.

The synthetic organic insecticides

Before the advent of synthetic organic compounds, the principal drawbacks to the use of insecticides were the high acre-dosage rates necessary for effective control and their high cost. Control measures were therefore largely cultural. When DDT appeared, new possibilities were foreseen, but this insecticide did not produce the required results and failed to give adequate control of that very important soil pest, the wireworm.

The mangold plants at the top have been damaged by white grubs; while the healthy plant at the bottom was grown in aldrin treated soil

BHC was next shown to be an effective insecticide for soil insect control, but the unfortunate property of this material in imparting a taint to root crops is known only too well to everyone interested in this particular problem. Apart from imparting taint, BHC has been shown to be phytotoxic in some instances when used as a soil insecticide.[1 2 3] It was at first thought that the imparting of taint by BHC might be associated with the isomers other than the insecticidally-active gamma isomer. However, off-flavour has been reported following the use of Lindane in the soil.[4] Chlordane has been used with considerable success as a soil insecticide, but off-flavour has also been reported following the use of this insecticide in the soil.[5]

Aldrin as a soil insecticide

Aldrin does not suffer from any of the above drawbacks, but possesses certain inherent advantages which make it extremely well suited for use in the soil and these will be summarised below. First, however, it may be of interest to explain why it is that aldrin, and not dieldrin, is chosen in most cases for soil insect control. The chief distinction between aldrin and dieldrin is that of their vapour pressures, and aldrin, with the higher vapour pressure of the two is much less persistent, while dieldrin has a residual life approximating that of DDT.[6 7]

When mixed with most soils, however, aldrin persists almost as well as dieldrin,[8] and this surprising feature of aldrin has been repeatedly demonstrated. Because dieldrin is manufactured from aldrin the latter is less costly to produce, and aldrin is therefore generally to be preferred for soil treatment on economic grounds.

The advantages of aldrin

The advantages of using aldrin for the control of soil insects are as follows:

With aldrin there is a wide margin of safety for most growing crops[9] and it has been shown not to affect germination when used at normal dosage rates. An extensive examination[10] where the soil treatment of growing crops and sampling was carried out in the U.S.A. under the direction of Federal and State Experiment Station personnel, has shown that aldrin is not absorbed by, and therefore not translocated within, the plant.[11]

Neither aldrin nor dieldrin has caused off-flavour or tainting in root crops grown in soil treated with these insecticides,[12] and the following crops have been shown to be free from unusual flavour characteristics when grown in aldrin (or dieldrin) treated soil: Potatoes, sweet potatoes,

Healthy roots of maize grown in soil infested with corn rootworms but which has been treated with 1 lb. aldrin per acre

turnips, carrots, radishes, onions and groundnuts. In Canada, for example, the Government authorities have approved the use of aldrin in the soil for the control of wireworms in root crops, including potatoes.

Aldrin remains stable in alkaline or acid soils and does not react chemically with the components of mixed fertilisers.[13]

Aldrin and dieldrin have no harmful effects on the micro-organisms normally found in the soil.[14] *

Aldrin and dieldrin are readily formulated into emulsible concentrates, wettable powders or dusts, and there is therefore a choice of material to suit the preferred method of application and no special equipment is required.

The amount of aldrin required for soil pest control will vary with the pests to be controlled, the stage of plant growth, the soil type and soil temperature, and method of application, but rates of application will lie between ½ to 5 lb. of aldrin per acre.

Pests controlled

Since it became commercially available, aldrin has been found to control over 20 important species of soil insects which attack the root systems of agricultural crops. Prominent among these are wireworms (*Agriotes* sp.) in maize and other cereals, sugar cane and sugar beets; larvae of various species of *Lachnosterna* (*Phyllophaga*) and *Melolontha*, commonly referred to as ' white grubs,' in sugar cane, maize, sugar beets, mangolds and small grains; rootworms (*Diabrotica longicornis* Say) and other species on maize and groundnuts, and mole crickets (*Gryllotalpa* sp. and *Scapteriscus* sp.) in a variety of crops, including tobacco seedlings. Aldrin has been shown to be outstanding for the control of the difficult-to-kill banana root borer (*Cosmopolites sordidus* Germ.).

Other susceptible soil pests are subterranean cutworms, *e.g. Crymodes devastator* (Brace), root maggots, *e.g., Hylemya brassicae* (Bouché) root weevils *e.g., Brachyrhinus sulcatus* (F.), and subterranean termites.

Methods of applying

(a) *Broadcast application*

In this method, the required amount of aldrin is applied uniformly over the surface of the soil and then worked into the soil during the final cultivation just prior to planting. The aldrin may be applied as a dust, in which case a dust formulation containing 2.5% or 5% aldrin is employed. The aldrin may also be applied in the form of a wet spray when, for example, 40% aldrin wettable powder, or aldrin emulsifiable oil is used.

(b) *Aldrin/fertiliser mixtures*

One of the most effective and economical ways of applying aldrin to the soil is in admixture with fertilisers, and this method has been used very successfully in a number of States in the U.S.A. and in Puerto Rico, where such treatment is widely used in sugar cane production. The method is rapidly gaining ground and it is anticipated that it will be adopted on an increasing scale in 1953. Aldrin is incorporated in the fertiliser as a wettable powder or dust concentrate in such a proportion to give the required dosage per acre when the fertiliser is applied at the usual rate. The mixing is normally carried out at the time when the fertiliser is mixed for bagging and, in the absence of other equipment, cement mixers have been found satisfactory for this purpose.

(c) *Band or spot treatment*

Aldrin is particularly well suited to band or spot treatment; the principal advantage of this being the saving in cost of materials. Band treatments require only one-quarter to one-third the amount of aldrin needed for broadcast treatments; the broadcast method will control a wider variety of soil insects and may remain effective for several years; band or spot treatments, on the other hand, should be repeated each year when susceptible crops are grown.

The most common method now in use for band or spot treatments is the use of an aldrin/fertiliser mixture. It is important to apply this correctly in order to effect the maximum degree of insect control on row crops. The aldrin/fertiliser mixture should be applied at the time of planting along both sides of the row or directly above it, close to, but not in direct contact with, the seed. If the mixture is applied on one side of the row and below the seed less satisfactory results may be expected.

An alternative method of using band treatment is to spray aldrin into the rows when the seed is planted. In this case, a low-volume sprayer such as is used for weedkillers may be used so that four to five gallons of spray solution per acre can be applied in the furrow and on the seed. In this case, ½ to 1 lb. of aldrin will normally be required per acre.

Some results from successful trials with applications of aldrin to the soil for the control of soil insects are given below.

Control of Cockchafer Larvae

Extensive trials were carried out in France in 1951 with aldrin and dieldrin for control of larvae of *Melolontha melolontha* L. on sugar beets, mangolds and

Roots of maize plant completely severed by corn rootworms

*Work on this subject is being continued in the United States in order to determine at what level, if any, these chemicals prove detrimental to soil micro-organisms.

(*Left*) **Healthy full-grown mangold grown in aldrin treated soil.** (*Right*) **Mangolds heavily damaged by white grubs**

potatoes. A dust containing gamma BHC was used for comparative purposes, and all three insecticides were applied at the rate of 0.75 kg./hectare (0.67 lb./acre) in the form of dusts, in spring before sowing or planting.

In the case of sugar beets, a substantial increase in the amount of sugar produced was recorded for all treatments. In the case of mangolds, 0.67 lb./acre of aldrin, dieldrin or gamma BHC all resulted in a gross yield by weight approximately 30% greater than that obtained without insecticides. The nutritive value of the mangolds, however, was higher when using aldrin or dieldrin than with gamma BHC.

	Sugar Beets, Tons Sugar per Hectare	*Mangolds, Nutritive Units per Hectare*
Aldrin	8.7	6,960
Dieldrin ..	7.2	6,500
Gamma BHC ..	7.5	5,720
Control	4.2	4,720

Although no complete harvest analysis could be made of the experiments with potatoes (because lifting had taken place before the date arranged) there were definite indications that a soil treatment with 2.2 to 4.4. lb. of aldrin or dieldrin per acre reduced the percentage of damage by white grubs from about 50% to below 3%. The results of these trials were presented to the Third International Congress of Crop Protection.[15]

Control of Sweet Potato Weevil in Puerto Rico

The control of the sweet potato weevil (*Euscepes postfasciatus* Fairm.) by application of aldrin made possible the commercial production of the most desirable varieties of sweet potato for the first time in Puerto Rico.[16]

The work was undertaken by the Rio Piedras Agricultural Experiment Station of the University of Puerto Rico. The results showed that before planting, fields should be sprayed with 2 lb. of aldrin per acre; this will eliminate ' white grubs ' and ' vaquita grubs ' (*Diaprepes abbreviatus* L.). Before planting, cuttings should be dipped in an aldrin solution (25% emulsion, 3 pints per 100 gallons), and as soon as the vines have covered the ground they should be sprayed with aldrin (25% emulsion, 4 pints per 100 gallons of water), and three times later at monthly intervals. This treatment resulted in 98% of the tubers being entirely free from insect attack and the yield 50% greater than in the untreated plots.

Control of Banana Root Borer

The banana root borer (*Cosmopolites sordidus* Germ.) has, in the past, been found difficult to control, partly because of its inaccessibility in the banana rhizomes. The efficacy of aldrin for controlling this insect was first demonstrated in Cuba, where the results were so striking that the Cuban Ministry of Agriculture distributed the insecticide free amongst small growers of bananas. Control of *C. sordidus* with aldrin has also been reported from the Canary Islands and Trinidad.

In commercial plantations, 2½ lb. of aldrin may be applied per acre, as 40% wettable powder being a suitable formulation to use. For new plantations, 1.25 lb. of aldrin in 40 gallons of water are applied per acre uniformly over the whole area. For ratoons and new plants one year old, a stock mixture of 1 lb. of aldrin in 50 gallons of water is applied to the soil surface every six months in a radius of 3 ft. around the plant at the following rates: New plants, 1 gallon; ratoons, 2 gallons.

Ant control

Many species of ants are effectively controlled by aldrin. These include the Argentine ant (*Iridomyrmex humilis* Mayr.), ' leaf cutting ' or ' parasol ants ' (*Atta* spp. and *Acromyrmex* spp.), the fire ant (*Solenopsis geminata* F.), the red harvester ant (*Pogonomyrmex barbatus* F. Smith), and the coffee shade tree ant (*Myrmelachista ramulorum* Wheeler).

Treatments vary according to species. For example, in Cuba, where the Ministry of Agriculture has distributed aldrin to smallholders for the control of *Atta insularis*, aldrin 20% dust is mixed with talc and injected into the nests. Recommendations for the control of *Atta* spp. and *Acromyrmex* spp. in Trinidad have been published by the Department of Agriculture.[17] The recommended method consists of spraying the holes of the nest and the ground in the immediate vicinity with aldrin (or dieldrin) at 1% concentration, although it is suggested that this concentration may be on the high side. In Australia, the Argentine ant has been successfully controlled with aldrin (or dieldrin) sprayed at 2% concentration. In Puerto Rico, coffee shade tree ants have been controlled for six months following a single application of aldrin emulsion at a concentration of 0.125% aldrin.

Control of Black Wheat Beetle in Kenya

The Dynastid beetle (*Heteronychus consimilis* Kolbe.) is a major pest of wheat in important wheat-growing areas in Kenya. From trials with aldrin, and BHC in various forms, for the control of *H. consimilis* aldrin was found to be the most effective material when used at the rate of 7.2 oz. per acre and applied with fertiliser.[18]

Sugar Cane Root Stalk Weevil in Puerto Rico

In Puerto Rico, aldrin is recommended by the Puerto Rican land authorities for the control of the sugar cane root stalk weevil (*Diaprepes abbreviatus* L.). Aldrin is applied at the rate of 2 lb. per acre mixed with the fertiliser and applied to the surface of the soil. The aldrin/fertiliser mixture is prepared by the fertiliser manufacturers.

Conclusion

The foregoing examples illustrate effectively the wide range of soil-inhabiting

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The Rice Industry in British Guiana

F. SEAL COON

WHEN indentured Indian labourers first came to British Guiana well over a century ago they began to grow rice for their own consumption from seed brought with them from India. That was the beginning of the rice industry in this country. The flat muddy coastal plain proved so suitable for the new crop that it was not long before the cultivators began to grow more than they needed for themselves and a domestic and export trade developed.

By 1938, average annual exports had reached some 19,000 tons after allowing for a domestic consumption of about 13,000 tons. Unfortunately, intense competition among middlemen and exploitation by landlords and millers depressed the return the growers were getting for their padi, and just prior to the Second World War the British Guiana Government was urgently seeking means to rescue the industry from complete strangulation.

During the war, the emergency need to regulate food supplies and conserve shipping gave the government opportunity to take control of the industry. Under Defence Regulations a Rice Marketing Board was established with monopoly powers of buying and selling. After the war, the Board was reconstructed on a more democratic basis. Its 16 members are appointed by the Governor and half of them are selected from the council of the Rice Producers' Association. This latter body was created by Ordinance in 1946, and is the officially recognised organisation of the rice producers of the country, including growers, millers, and landlords.

During the year 1951, deliveries to the Board totalled nearly 47,000 tons of rice, of which over 28,000 tons were exported. In addition, nearly 12,000 tons were retained by the producers for their own consumption and 12,000 tons of padi (equivalent to about 7,300 tons of rice) were used for seed and stock feed.

The Rice Marketing Board is now in a sound position, and the advantages of putting more money into the hands of producers with which to improve land, buy better seed and purchase or hire equipment for mechanical cultivation have become apparent.

Government initiative

The war-time need for greater food production, accentuated by the loss of Burma, led the British Guiana Government in 1942 to take the courageous step of starting the Mahaicony-Abary Rice Development Scheme, which included a mechanised farm and a central rice mill.

In WORLD CROPS, *Vol. 2, p. 420, we published a review of the position in regard to mechanised rice production in British Guiana. Since then the situation has developed and in the following the present position is again briefly surveyed.*

Map of British Guiana, showing position of Mahaicony-Abary scheme

Some 11,000 acres of land were empoldered and drainage and irrigation works set up. Machinery had to be ordered hurriedly, with no previous experience as a guide. It was not surprising that, under the entirely new and war-time conditions, considerable difficulties were encountered. Most of them have been overcome, though the problem of ' red rice ' (an uncultivated type whose grain shatters and drops easily, making it unsuitable for mechanised cultivation, besides spoiling the appearance of the rice by its red colour) has still to be solved. Grazing down by cattle between crops, and growing from seed free of the ' red rice,' are possible answers. It was originally intended to farm 5,000 acres, but it is only now that an estate known as Onverwagt, on the east bank of the Abary River, has been taken into the scheme that the acreage planted has exceeded 4,000. This year 6,000 acres were planted, and whereas last year 4,000 acres produced only 40,000 bags of padi, it is anticipated that the crop now being harvested will yield 100,000, or an average of 16 bags to the acre, against last year's 11.

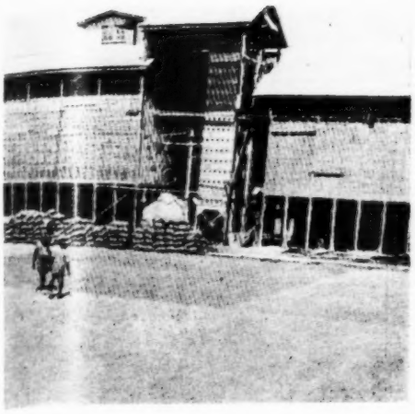
A total expenditure of BG.$3,600,000 has been, or will be, made to bring the scheme into maximum production by next year, and additional plant and buildings are being erected. About BG.$2 million of the expenditure to date has been provided out of Colonial Development and Welfare or Colony funds, and this must be regarded as non-recoverable development expenditure. Nevertheless, the scheme will probably show a gross profit of some BG.$400,000 this year, so that it has definitely shifted from an experimental to a commercial basis.

More irrigated land

With a practical assurance of high prices and avid markets for years to come, it has become clear that in the rice industry of the coastlands lies one of the colony's chief hopes of future prosperity, and the large and growing East Indian population is peculiarly suited to its expansion.

The amount of drained and irrigated land available is limited, however, and present expansion is taking place largely at the expense of grazing, with the result that the beef supply is suffering. The obvious need is for much more land free of the curse of recurrent flooding and drought, and interim projects for bringing in some 42,000 acres of new or improved ricelands are being carried out on the Corentyne coast.

The most important developmental projects in this direction are the five great water control schemes designed to capture the headwaters of some of the many rivers, form reservoirs, and command the whole coastal area from the Corentyne to the Pomeroon. The estimated cost of these five projects exceeds BG.$100 million, with as much again for the subsequent settlement of population on the new lands, but this order of funds is not within sight at present. One scheme, to cover over BG.$7 million, which will take five years to complete, has been authorised and a free grant of BG.$4½ million made towards the cost by Her Majesty's Government. A grant of $621,000 (U.S. currency) is also being sought from the ECA. This project is sited between the Demerara and Essequebo Rivers: it is likely that the next to be approved is that lying west of it between the Essequebo and Pomeroon



Rice mill and drier with padi stacked ready for drying. From the elevator, padi falls through currents of heated air to dry out excess moisture before storing

Rivers. The most important is, however, the Canje Project in Berbice, though authorisation (and funds) for it is not yet forthcoming.

In order to justify such heavy expenditure, the new lands will have to be brought into remunerative production very rapidly and, although it is proposed that rice growing should remain in the hands of individual farmers, it is doubtful whether their traditional methods will suffice. Two American rice experts, whose services were made available during 1949 and 1950, recommended a padi-livestock rotation as being the only possible way of justifying the capital expenditure required, and this seems to be a reasonable and logical development with many advantages.

Colonial Development Corporation

Even then, expansion is going to be too slow unless an element of purposive direction is injected. The elimination (possibly with compensation) of small, inefficient and ill-equipped private mills and their substitution by strategically placed modern central mills was strongly recommended, and led to the proposal for a large development corporation or company, capitalised by the Colonial Development Corporation.

A C.D.C. mission visited the colony, but its findings were not wholly favourable and the proposals eventually made by the corporation were not found acceptable by the British Guiana Government.

Following further negotiation, the corporation has agreed to subscribe capital in the form of loans, and a British Guiana Rice Development Company has now been formed with an authorised capital of BG.$10 million, of which the Colonial Development Corporation will provide BG.$5 million in short- or medium-term loans at interest showing a small premium above the cost of the Treasury advances to the corporation. In addition, BG.$2 million is to be allocated in shares to the Government and the Rice Marketing Board in respect of the assets of the Mahaicony - Abary - Onverwagt Scheme. The company will work in close collaboration with the Rice Marketing Board, which will handle all its exports as it does the rest of the colony's production. It is possible that the board may one day face a demand for its conversion into a co-operative, though it is difficult to visualise how this can be accomplished if the organisation is to retain its present close monopoly and price-fixing powers granted by law. On the other hand, the company may be thrown open to public participation, particularly by rice producers, once it is soundly established and the time comes to re-finance it.

Promising markets

Clearly, expansion is the order of the day for British Guiana's rice industry, and there seem to be few grave obstacles in the way if finance can be obtained and proper use is made of it. One possible stumbling-block is the flat rate of four dollars an acre it is proposed to apply to all new or improved lands taken up in the areas covered by the projected water control schemes. This may prove too heavy a burden for ricelands in course of development to bear.

Other things being equal, however, there are promising markets open in parts of the British West Indies (Jamaica, for example), Surinam, Venezuela and Brazil, whilst Canada has shown interest and there are, of course, the insatiable markets of the East. Both Trinidad and Jamaica are experimenting with rice growing, but it seems improbable that they will be able to supply even their own requirements for many years, if ever, so that British Guiana's export prospects are good—and improving.

(*From ' Colonial Development.'*)

Reapers in echelon

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(*Continued from page* 279)

insects which are susceptible to effective control by the employment of aldrin.

REFERENCES

Compton, C. C., and McCauley, W. E.: ' Use of Aldrin and Dieldrin in Soil Widens Scope of Pest Control ' (paper presented at Ninth International Congress of Entomology, Amsterdam, 1951).

1. Morrison, H. E., *et al.*: *Jour. Econ. Ent.*, **41**, 3, 374 (1948).
2. Stoker, R. I.: *Ann. App. Biol.*, **35**, 1, 110 (1948).
3. Stitt, L. L., and Evanson, J.: *Jour. Econ. Ent.*, **42**, 4, 614 (1949).
4. Stitt, L. L.: *Jour. Econ. Ent.*, **44**, 1, 87 (1951).
5. Tiedjens, V. A.: *Agricultural Chemicals*, **7**, 3, 45 *et seq.* (1952).
6. Teotia, T. P. S., and Dahm, P. A.: *Jour. Econ. Ent.*, **43**, 6, 864 (1951).
7. Julius Hyman and Co.: ' Rate of Volatilisation of Aldrin, Dieldrin, Lindane and DDT ' (1949).
8. Fleming, W. E.: Unpublished report (1950).
9. Bauer, C. L., and Dahm, P. A.: ' Field Plot Studies of Compound 118 ' (paper presented at 61st Annual Meeting Am. Assn. of Econ. Ent., Tampa, 1949).
10. Shell Chemical Corp./Julius Hyman and Co. Report: ' Quantitative Analysis for Aldrin in Crops Grown in Aldrin-treated Soil,' issued February 1952, pp. 146.
11. Danish, A. A.: Exhibit 1287: Residue Data, Affidavits and Analytical Procedures; F.D.A. Hearings on Residue Tolerances, Washington, D.C. (1950).
12. Morrison, H. E., and Crowell, H. H.: ' Tests with Residual Soil Insecticides ' (paper presented before Pacific Branch A.A.E.E., June 1951).
13. Lidov, R. E., *et al.*: Advances in Chemistry Series, No. 1, p. 175 (1950).
14. Morrison, H. E., and Crowell, H. H.: ' Tests with Residual Soil Insecticides ' (paper presented before Pacific Branch A.A.E.E., June, 1951).
15. Dalmeyer, W. H. M.: ' The Use of Aldrin and Dieldrin Against the White Grub of the Common Cockchafer ' (paper presented at the Third International Congress of Crop Protection, Paris, September 1952).
16. Wolcott, G. N.: Press release, August 6, 1952.
17. Fennah, R. G.: Proceedings of the Agricultural Society, Trinidad, September, 1950.
18. Le Pelley, R. H., and Goddard, W. H.: *Bull. Ent. Res.*, **43**, Part 2, 403 (1952).

Amazon Timber Possibilities

Hope bids fair for a large timber industry in the Amazon valley, according to a team of forestry experts who have returned from a FAO mission. The experts says that the Amazon, now a fiscal burden to the Brazilian Government, can, at least as far as agriculture and forestry are concerned, be made entirely self-supporting within ten years. The favourable aspects of the Amazon as far as forestry is concerned are the magnificent system of waterways, the general topography and the open nature of the jungle which allows the easy removal of logs. Modern methods of extraction and industrialisation could so reduce the cost of Amazon lumber that a much greater market could be opened than even the quite considerable one existing within Brazilian borders today.

Mechanised Agriculture in Fiji

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Throughout the tropics practical interest in the possibilities of mechanisation of agriculture is expanding rapidly. In the following article taken from the Fiji Agricultural Journal an account is given of recent developments in the British Colony of Fiji.

IT appears that prior to the last war American crawler tractors had already attained a certain degree of popularity in Fiji, but the shortage of dollar exchange apparently put a period to expansion in this direction and it was suggested that some of the British wheeled-type tractors might prove suitable for Fijian conditions. The Fijian Agricultural Advisory Council considered the matter and recommended the purchase and trial of a number of these.

Five tractors were imported, and arrived during 1949. They were put to work on the principal agricultural station at Koronivia (where a sixth was already in use) in order to compare their relative merits, and more particularly the merits of the various classes of machines which they represented. The notable success of the light pneumatic-tyred rowcrop tractors has helped to popularise this class and bring about the big change in tractor numbers which has recently occurred.

Recent developments

In the last three years, tractor numbers have increased very rapidly from a total of about 60 to over 200. Nearly all of the 60 were diesel-engined crawlers, while the total at March 31, 1952, is made up as follows:—

Horticultural:	
B.M.B.	2
Ransomes	5
	7
Wheeled:	
David Brown	1
Farmall	5
Ferguson	135
Fordson	14
	155
Crawler:	
Bristol '20'	2
Caterpillar	42
Fordson 'County'	3
Fowler	8
International	3
	58

These figures, which may contain some errors, are exclusive of tractors used on non-agricultural work such as timber hauling.

Results of tests

While the group of tractors was under trial at Koronivia, their relative merits under Fiji conditions were shown up by practical work, and advice was given to interested enquirers. Briefly, the baby two-wheeled B.M.B. 'Plowmate' has proved hard to handle, and the tool bar and implements have given evidence of weakness. On the other hand, another small horticultural tractor, the Ransomes 'MG5,' has proved very useful and has given negligible trouble; but owing to its tracks its cost is comparatively high. The Ferguson has become very popular owing to its comparatively low running cost and its versatility. Considerable trouble has been experienced with the Bristol '20,' both mechanically and when ploughing; for general conditions the wide-track model which was recently put on the market would be more stable. The David Brown 'Cropmaster 65' has a little more power than the last two, but the absence of an agent in Fiji and the lack of facilities for servic'ng have precluded its becoming popular. In addition to these tractors, a Fordson 'Major' has been in use on the station for three years. It is a powerful tractor, especial'y when fitted with half-tracks; however, its fuel consumption has proved to be high in relation to performance.

Public demonstrations

Three public demonstrations were held in 1951. The first was at Koronivia on July 11. In addition to the B.M.B., Ransomes, Ferguson, David Brown, Bristol and the station's Fordson 'Major,' a Fordson 'County' on loan from the agents was shown. To demonstrate the large range of Ferguson implements, the agents lent a second Ferguson tractor. A large and representative gathering attended, and the weather was kind. Trailed implements were used and changed every hour. For example, the David Brown was ploughing for the first hour; then it operated an Atkinson Manure Spreader (spreading coral sand), and then an International semi-mounted mower. The total range of implements shown included disc and mouldboard ploughs, disc harrows, culti-

Ferguson (TE.-A20) and two plough mounted disc plough being used in Fiji

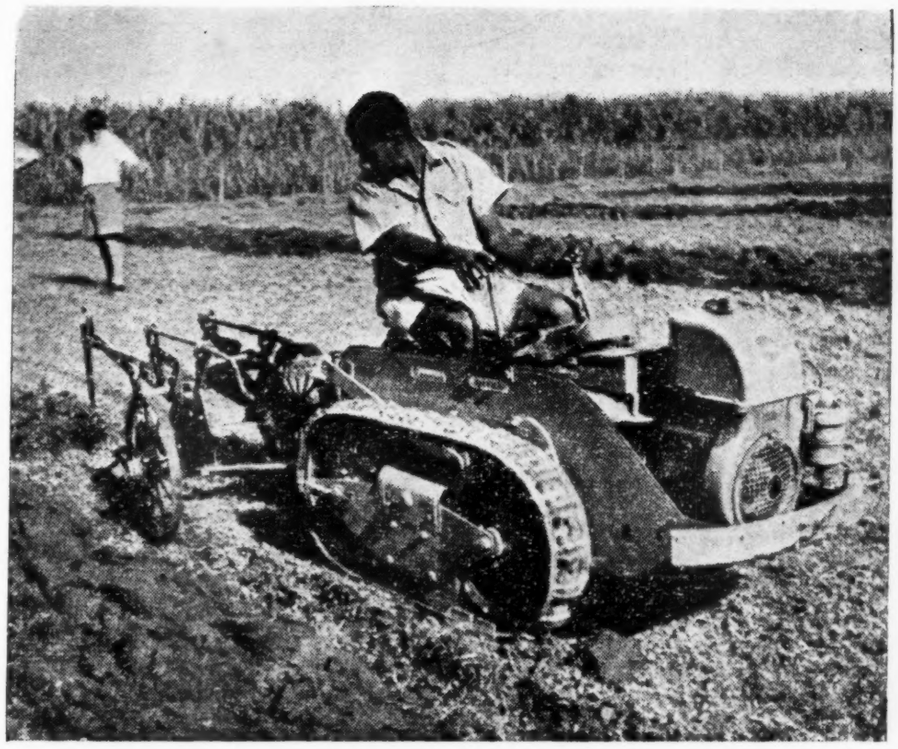
vators, mowers, hoes, and ridgers, a mole plough, a swamp plough turning an 18 in. furrow, a sack lifter, and a saw bench. A brief description of each of the different tractors and implements was given, and there were some interesting discussions. In the afternoon, a more direct comparison of the various tractors was provided by having them all ploughing, and later ridging, in the same field at the same time.

The second demonstration

The second demonstration was held in the Tailevu dairying district on August 28, Mr. L. Hunt very kindly making his land available. The attendance was again large, and the weather good, so that the full programme could be carried out as planned. Emphasis was placed on grassland work and pasture rejuvenation. A small area of weedy but close-grazed carpet grass pasture had been ploughed up and planted to Para grass in the previous fortnight, in order to show the effects on the finished job of four very different ploughs. These four were a disc plough, a semi-digger, a swamp plough turning a wide flat furrow, and a Rome heavy scalloped disc harrow used twice. A long dry spell followed the planting and it is now clear that the mouldboard ploughs have given the better stands of Para grass. On the day, old grass was ploughed up in various ways and then worked down by disc harrows. Disc, tine, and chain harrows were used to rejuvenate old Para and carpet grass pastures. A manure spreader, various mowers, mole ploughs and a subsoiler were shown, and a demonstration given of digging a shallow drain using a trailing and a tractor-mounted grader. The tractors demonstrated were Fordsons, Fergusons, a David Brown, and a Caterpillar D2; each worked for ten minutes or so, one after another in continuous succession. A Land Rover was also demonstrated pulling first disc harrows and then a mower. The total number of implements shown was just under 30, of which a number were lent by neighbouring farmers.

Horticultural tractors

The final demonstration, on August 30, was of horticultural tractors and was held at Lodoni; it was remarkable chiefly for the lack of interest it aroused. It is apparent that only rarely will these ' babies ' compete economically with bullocks in Fiji. The smaller types are of very limited use; the larger are not very much cheaper than medium-powered tractors, with which a man can earn extra money by contract work. The B.M.B. Plowmate, Ransomes MG5, Sam's Gardener, and Allen Scythe were shown with their associated implements, in the grounds of the Ratu Kadavulevu School. A not uncommon fallacy is that a small farmer or peasant farmer only needs a small machine; but while it is true that speed of work is of comparatively little importance, depth of work (of ploughing, etc.) is important and cannot be reduced.



Ransomes ' MG 5 ' and single-furrow mouldboard plough

Medium-powered tractors

While heavy crawlers are still required for breaking in rough country, it is apparent that these medium-powered tractors can cope with nearly all other normal work; mole draining is (possibly) the only exception, but even this can be done by the use of a winch. Their much lower capital cost results in lower operating costs; and their much greater versatility enables cropping to be more completely mechanised. Some of the methods being evolved at Koronivia may be of interest. For example, instead of growing kumalas in hills, with hand implements, the land is ridged at 30 in.; the actual planting of the cuttings is by hand, but intercultivations are done two or three times with a spring tine cultivator and once with a subsoiler. Lifting is satisfactorily carried out by a potato plough, after dragging off the tops with a cultivator. Tapioca is grown in the same way, experiments having shown that under these conditions the optimum spacing of the cuttings is 15 in. apart. This close spacing induces a dense canopy which controls weed growth when the tractor intercultivation is no longer possible. Sugar cane, a very important crop, is on the whole the most mechanised crop in Fiji, although harvesting is still done by hand. For inter-cultivation a high-clearance or a narrow tractor is desirable. When intending to straddle a row with a tractor and light-mounted cultivator with a central steerage fin, an extra fin should be obtained and one fin mounted on each side of the tool bar, leaving the centre clear; by this means work can be done right up to the cane in the row. An idea for ensuring parallel drills, applicable to a row crop tractor and mounted tool bar, is to set the wheels to the row width (say, 54 in.) and to mount two ridging bodies at this distance apart. On each run after the first the tractor is driven with one wheel in the last drill, in order to complete the old drill and half form a new one. A cane-planter which has operated successfully in Australia is now available here, the sets being fed into the machine by hand.

Mechanised rice growing

The possibilities of mechanising rice growing are under investigation at the present time at Koronivia. Preliminary results suggest that in the wet zone there is no great benefit from transplanting; the use of a corn drill on well-drained land has resulted in good crops, and the cost has

been vastly reduced. Attention is now being given to harvesting and to weed control by the use of a steerage hoe. For work in swamp conditions heavy tractors are useless. The Ferguson fitted with double rear wheels and the Ransomes MG5 have so far shown great promise.

Conclusion

To conclude, mechanisation is progressing rapidly in Fiji, and will undoubtedly continue to do so. The versatility and economy of medium-powered row-crop tractors on rubber tyres are the cause of their gaining popularity. The efficiency of the servicing facilities provided by the local agents must be mentioned as a matter of prime importance in a country so far from the factories. Finally, efficiency is now being limited not by the design or the supply of tractors, but by the general lack of skill and of training of the drivers.

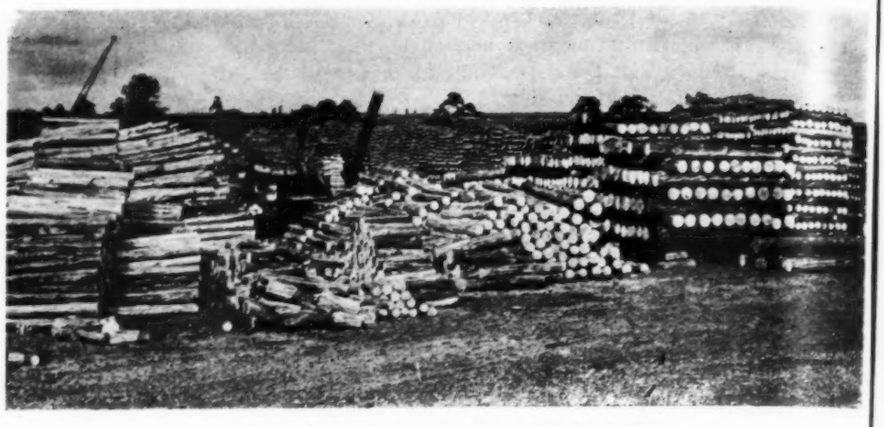
National Institute of Agricultural Botany

The National Institute of Agricultural Botany have just published the latest issue of their journal. This issue includes the papers read to the Crop Conference held by the Institute last December and reports the discussions on the different varieties of wheat, of fodder beet, and of potatoes. These reports bring together for the first time a great deal of information which has been slowly accumulated by the Institute over the years. Any farmer who is interested in using the most suitable varieties would be well repaid by a study of these papers. Those who were sufficiently fortunate to have attended the conference itself will be glad to have this permanent record of the proceedings.

The journal also contains two papers on oats giving the results of variety trials which have been held over the last few years. A paper from the Cereal Research Station at St. Albans, which discusses variations in the kernel content of oats within the variety, finds these differences to be almost as great as those reported between extreme varieties.

Other topics covered by papers in this issue include reports on trials of brussels sprouts, on the effect of sowing date on the incidence of faulty heads in January King cabbage, and on an enquiry into the occurrence of off-types mixtures and hybrids in some Brassica varieties.

Copies of the journal are issued free of charge to all Fellows of the Institute, and may also be obtained, price 10s. post free, from the Secretary, National Institute of Agricultural Botany, Huntingdon Road, Cambridge.



A stack of pit props from Thetford Chase

Forestry in Great Britain

Western hemlock

Western hemlock (*Tsuga heterophylla*), introduced into Britain from Western North America in 1851, is now regarded as a most promising timber species of the second rank. Up to 1947, all the known plantations of this species in Great Britain totalled only 1,076 acres—of which about 70% were under 21 years old. There are doubtless, however, many uncounted small plots and groups, for the tree is particularly beautiful, combining some of the good features of the silver firs and the deodar, and it has therefore been planted in some places for ' amenity.'

Tsuga heterophylla (the American name of hemlock is evidently deplorable) is a shade-tolerant, moisture-demanding species. Boles are of a naturally good form, straight and with slight taper, and only occasionally spoilt by fluting. The sample plot shown in the photograph is one of the best in England and received mention at last year's British Commonwealth Forestry Conference at Ottawa. It stands at an elevation of 600 ft. above sea level, about 2 miles inland, at East Quantoxhead in Somerset. It was then 51 years old, with a mean height of 86½ ft. and mean girth at breast height of 38 in. The volume per acre was calculated at 6,336 cu. ft.

Pitprops

Planting in Thetford Chase (40,000 acres, and England's second largest forest) began as recently as 1922, thinning started only in 1938, yet there is already a large outturn of pitprops. The 24-acre produce depot at Brandon, adjoining the railway station, now handles well over 2 million cu. ft. of timber a year, and of that total no less than 35% goes to the mines as pitprops.

A few choice Scots pine and larch poles qualify as telegraph poles, ladder poles and flag-poles; rather more go to make wireless, scaffold and rustic poles; and great quantities of small stuff goes for pulpwood and fibre-board. Fencing posts, wood wool and boxwood are other forms of utilisation but pitprops remain much the most important single item in the 1,000-tons-a-week output of Thetford Chase.

J. D. WARD

Western hemlock growing at East Quantoxhead in Somerset

Rice in Rumania

JOHN CARDEW

Increased demands and high prices for rice are stimulating rice production in many countries of Southern Europe. The latest country from which not inconsiderable developments have been reported is Rumania. Some details concerning these are given below.

FOLLOWING large-scale irrigation development in recent years, Rumania has now become an exporter of rice. Although the crop was grown in the country before the war, especially in selected areas along the Danube, yields were poor and production was not significant. Since the end of the war, however, Government plans for agriculture have concentrated a good deal on rice and in most cases it has been a priority crop on lands made fertile by various irrigation schemes.

So far exports are believed to have gone to Rumania's East European neighbours, but it would be in line with current Rumanian trade policy for markets to be sought in the West as well. This would certainly be the case if East-West trade were to return to something like its former volume and Rumanian grains and other foodstuffs were to assume once again the importance they have traditionally had in inter-European trade. Meanwhile, it is interesting to note that decorticated rice is listed in the latest export catalogue issued in English by the Rumanian Chamber for Foreign Trade. The catalogue was distributed at an industrial exhibition held in Bucharest early this year and attended by a number of Western commercial representatives.

Rapid rate of development

In 1938 the irrigated area under rice in Rumania was only some 800 acres. By the end of 1951 this had been increased to over 42,000 acres and in the course of last year an additional 52,500 acres irrigated by river control schemes were put under rice. During the past six years, dams erected along the lowlands of the Danube, Prut and Siret Rivers have made productive 130,000 acres of land, the best of which was devoted to rice, cotton and vegetables.

It has been officially announced that damming and irrigation are 'to continue to be a permanent State task' in Rumania so that rice will assume increasing importance in agricultural production. For the first time irrigation was carried out last year on elevated and sloping areas along the route of the Danube-Black Sea canal and rice is one of the crops being planted in the once-barren Dobrudja region through which this new waterway is passing. According to surveys so far made, 3 million acres of land in Rumania can be irrigated 'in the near future' by using the existing inland water-courses. In 1953-55 irrigation is to be extended in southern Rumania to 75,000 acres under rice, 100,000 acres under cotton, and over 260,000 acres under vegetables and leguminous plants. Major projects now under way are to irrigate 750,000 acres on the Baragan steppe and 100,000 acres along the lower reaches of the River Olt.

Rice cultivation in the Danube Delta

Rice is now being cultivated on an extensive scale in the Danube Delta. Ever since 1949 reclamation work has been going ahead on the numerous islands formed where the Danube flows into the Black Sea. Of the total delta area—over 1 million acres—approximately 130,000 acres are suitable for cultivation and much of this will eventually comprise rice plantations protected against Danube floods. In the spring of 1951 cotton and rice were planted on 40,000 acres of this reclaimed land. Last year in southern Rumania, between the Rivers Arges and Dunarica, 1,750 acres of rice fields were reported to be giving good yields in an area formerly noted for a massive growth of sedges.

Although they cover just over 6% of the arable fields in Rumania, State farms last year accounted for no less than 65% of all the country's ricefields. The role of Rumanian State farms is to practise the most advanced forms of agriculture, and in this way to teach individual peasant owners, by example, the advantages of new

Irrigating a Rumanian rice field, and (*top*) a rice crop on a collective farm

methods. Because of the heavy cost involved in irrigation at the outset, and the absence of extensive rice cultivation before the war, the considerable expansion that has taken place since the end of the war would not have been possible but for the work of the State farms. Collective farms are now increasingly planting rice and reporting good yields. One farm on the Danube near Bucharest has rice plantations covering 2,500 acres and has produced 5,000 tons of rice in a year.

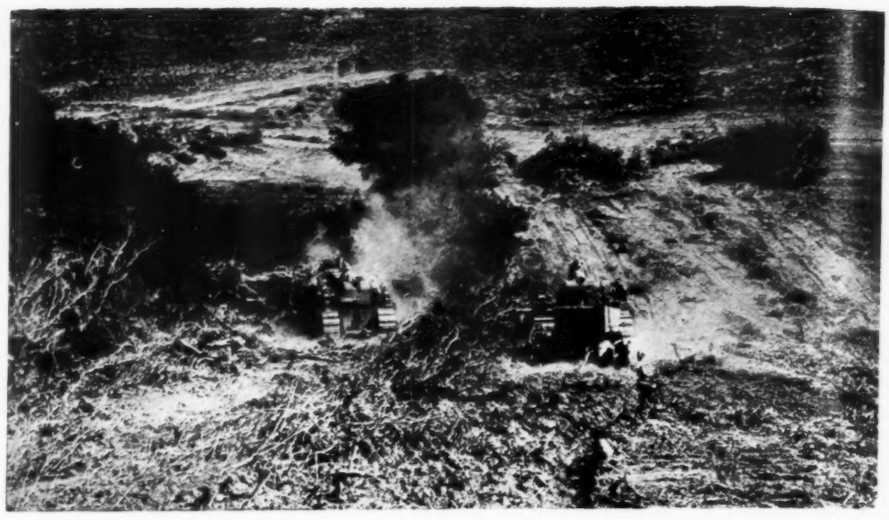
Rice Yields

Pre-war rice yields in Rumania averaged 1,950 kilograms per hectare. Under the present Five-Year Plan the yield is scheduled to reach 3,150 k.p.h. for the country as a whole and 3,300 k.p.h. on State farms. The highest yield so far reported, 4,000 k.p.h., was obtained in one of the most favoured regions along the Danube. There has been a big increase in the use of fertilisers, and this year for the first time only selected seed is being used.

An irrigated rice plantation in Rumania

International Agricultural Fair

Fourteen countries participated in the International Agricultural Fair held in Utrecht from April 27 to May 2. The exhibits from England, Germany, France, the United States and the Netherlands formed the bulk of this international exhibition of machinery and tools for agriculture and horticulture.



An International TD-18A tractor drags a bush and bog harrow to destroy roots that might have been missed in previous operations

Mechanical Brush Clearing

During the past two years, ranchers of Monterey County have established themselves as leading exponents of mechanical brush clearing in California. There are several reasons for the sudden emphasis on clearing range land of brush. California's population is gaining at the rate of 25,000 people a month, and pressure on the land is increasing. Moreover, ranchers only produce enough meat to satisfy 50% of the demand in the State, and in order to increase production of beef they are utilising 20 million acres of brush land for the expansion of livestock production.

At first, burning the brush was tried but was soon abandoned because of the rapid regrowth of roots and seedlings, while chemical spraying was thought too slow. Before resorting to mechanical clearing, however, the question of cost per acre and the type of forage crop or seed had to be considered.

All doubts were dispelled when, after two years of experiment, it became apparent that land could be cleared for not more than $20 per acre and for as low as $10, depending on the type of brush. During these demonstrations it was found that all sizes of International crawler tractors did a fine job of bulldozing brush. In the two years since the promotion of mechanical brush clearing, more than 5,000 acres have been cleared by bulldozers, worked with harrows and discs and seeded to grasses and cereals. Many areas in central California, too dry for growing perennial grasses, have been seeded to barley or oats the first two years and then allowed to revert to native annuals. Thus treated, they have produced wonderful stands of burr clover, alfalfa and wild oats. Moreover, many springs that have been dry for years have started to flow again, proving that brush dissipates water rather than conserving it.

Ranchers using mechanical methods claim that the crawler type tractor has become an important and economical tool in clearing brush. Cheapest in the long run, its special advantages are that it prepares the land for a useful crop immediately and destroys the brush more permanently.

Irish Tillage Acreage

The low tillage acreage is one of the fundamental causes of the inadequate agricultural output in Eire, Mr. Walsh, Minister for Agriculture, said, when presenting the prizes in the National Ploughing Championships at Mullingar, at the Royal Spring Show in Dublin, but the indications are that there will be a big increase in tillage this year.

As a result of this low tillage acreage large quantities of wheat, maize and sugar have to be imported. All crops, he continued, must be made to give bigger yields, and experiments had shown that money spent on fertilisers was the farmer's best investment. In the present financial year, the Department of Agriculture had made available a special recoupment to cover the cost of manures for a large number of demonstrations on tillage crops and grasslands.

Dutch Research on the Mechanical and Chemical Control of Imperata Grass

THE harmful effects of the tropical Imperata grass or Lalang grass on such crops as rubber, tea or coconuts are well known (WORLD CROPS, 1951, Vol. 3, pp. 143 and 396). More recently, the problem of mechanical and chemical control of the grass has been made the subject of research by Dutch research institutes in Java. Results have been published by E. J. van Alphen de Veer and A. P. A. Vink, in the journals *De Bergcultures* and *Tectona*.

Up to a short time before World War II it was usual to counter the Lalang menace by means of deep cultivation and manual eradication of the roots, followed by the cultivation of some rapid-growing cover plants. Although manpower was comparatively cheap, the method was scarcely economic, and many Indonesian estates preferred the cheaper, yet less efficient method of shallow manual cultivation during the rainy season.

However, the Lalang menace grew steadily worse; it assumed vastly increased proportions during the war when the estates were neglected, and the growing cost of manpower after the war provided a further impetus for the introduction of mechanical and chemical control methods.

Postwar control

The mechanical method, more appropriately termed ' motorised control,' consists in the ploughing of the infested areas with the aid of tractor-hauled tillers; the chemical treatment consists in spraying the area with weedkilling chemicals.

For the effective control of the weed, it was obviously essential to obtain objective data to compare the results of the different mechanical and chemical methods in use. As it happened, the Dutch Forestry Research Institute at Bogor (Java) had been concerned, for some time, with measures to localise the Lalang-infested areas by means of weed-free corridors which could also serve as fire protection belts against the frequent conflagrations caused by the dry grass. Pilot tests with two types of chemicals, *viz.* sodium arsenite and Shell 'Weedkiller K,' had been carried out in 1950 and seemed to show a superiority of the latter. But the trials were not on a large enough scale to be conclusive.

Meanwhile, another Dutch research institute (' Experimental Station for Perennial Crops '), likewise at Bogor, had started experiments with mechanised control methods. In April 1951, the two institutes

Three doses of 15% sodium arsenate after 1½ months reduced Lalang growth to an average height of 20 cm.

decided to join forces and proceed with a joint research programme which was carried out in the time from July to November 1951 on land placed at their disposal by two rubber plantations in the vicinity.

The programme covered the following methods:—

(*a*) ' Weedkiller K '; three sprays, approx. 1,120 gal./acre.

(*b*) ' Weedkiller T '; three sprays, approx. 1,300 gal./acre.

(*c*) ' Weedkiller K '; four sprays, approx. 1,430 gal./acre.

(*d*) ' Weedkiller T '; four sprays, approx. 1,500 gal./acre.

(*e*) Shallow mechanical cultivation, 6 in., four times.

(*f*) Shallow mechanical cultivation, 6 in., twice, followed by one spray of ' Weedkiller K.'

The plot in the foreground has been sprayed three times and that in the background has been ploughed twice

(*g*) Shallow mechanical cultivation, 6 in., three times (without chemical treatment).

The tests were carried out under appropriate scientific control, and records were kept of all the relevant incidental factors (rainfall, etc.).

Test results

It was found that the weedkiller treatment, even when repeated three or four times, did not permit an effective permanent control of the Lalang grass. After some months, the plots thus treated were again covered by vegetation mostly consisting of grass. The use of larger quantities might have had a better effect but would have incurred prohibitive costs, all the more so as the chemical treatment had to be followed by shallow cultivation to permit crop growing. One of the plots, where no such mechanical treatment followed, reverted very soon to its original state.

On the other hand, the tests with repeated mechanical treatments (shallow cultivation) were remarkably successful. The Lalang grass was eliminated at least to such an extent that vegetable crops were able to gain control. However, the return of vegetation on the tilled fields should not be left to chance; it should be promoted, for instance, by the use of wood ash, a ubiquitous cheap manure.

Conclusion

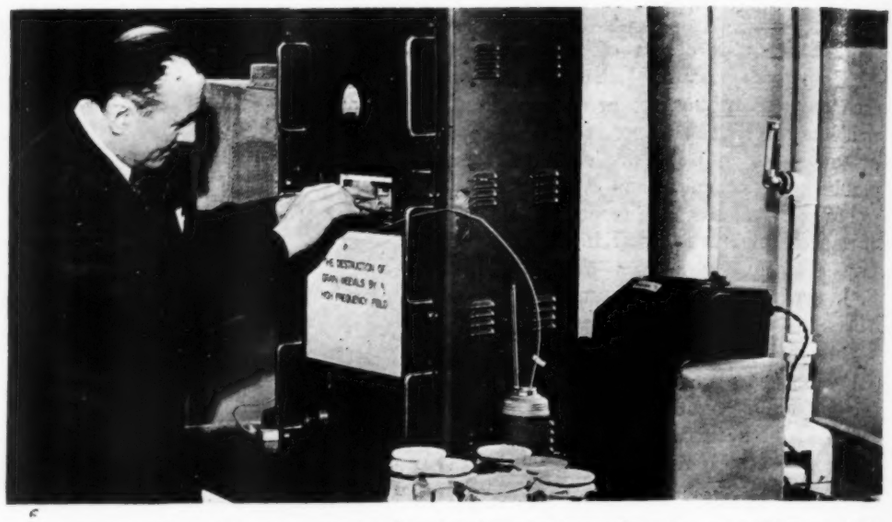
In conclusion, the use of repeated shallow ploughing is considered to be the best method under the normal conditions prevailing, *e.g.* in West Java. The use of deep ploughing methods can only be justified where more suitable tillers are not available, or where the crops themselves require deep cultivation on account of special local soil conditions.

Plant Breeders' List

FAO has just published a ' World List of Plant Breeders ' which is a supplement to the ' List of Plant Breeders in Canada and the U.S.A.' published in 1949. The new list will be distributed free to all plant breeders named in the publication as well as to those registered in the first list. These two lists together contain the names and addresses of about 2,100 breeders in 49 countries and territories, as well as information on the crops with which they work.

The Electrical Research Association's Open Day

AN open day was held recently by the Rural Electrification Section of the British Electrical and Allied Industries Research Association at its Shinfield Field Station near Reading. The section has for its objective the development of equipment and techniques which will be of use to farmers or growers and which, at the same time, will favour the economic use of electricity. The field station, which was established in 1945, is intended to provide facilities for research in this connection.



A demonstration of the apparatus for the destruction of grain weevils by a high frequency field

The field station

The field station occupies an area of some three acres and is divided into two parts, one accommodating laboratories and workshops and the other providing plots for field experiments. There are two laboratory buildings and a small building to house the heat pump installation. The gardens have experimental plots laid out with Dutch-lights, or cloches, and others where the crops are uncovered. Most plots have electric soil warming. The two main glasshouses are divided internally into compartments for experimental purposes, and there are three smaller glasshouses and a small building for experimental work on grass drying.

Glasshouse and farm display

Much of the work is concerned with the control of growing conditions for glasshouse crops and methods of controlling the main growth factors electrically were demonstrated.

The display included a plan of a mixed farm showing existing electrical devices and others which might be introduced in the future to ease the farmer's labour problems, to increase productivity and the quality of products, and to improve the economical use of electricity in rural areas.

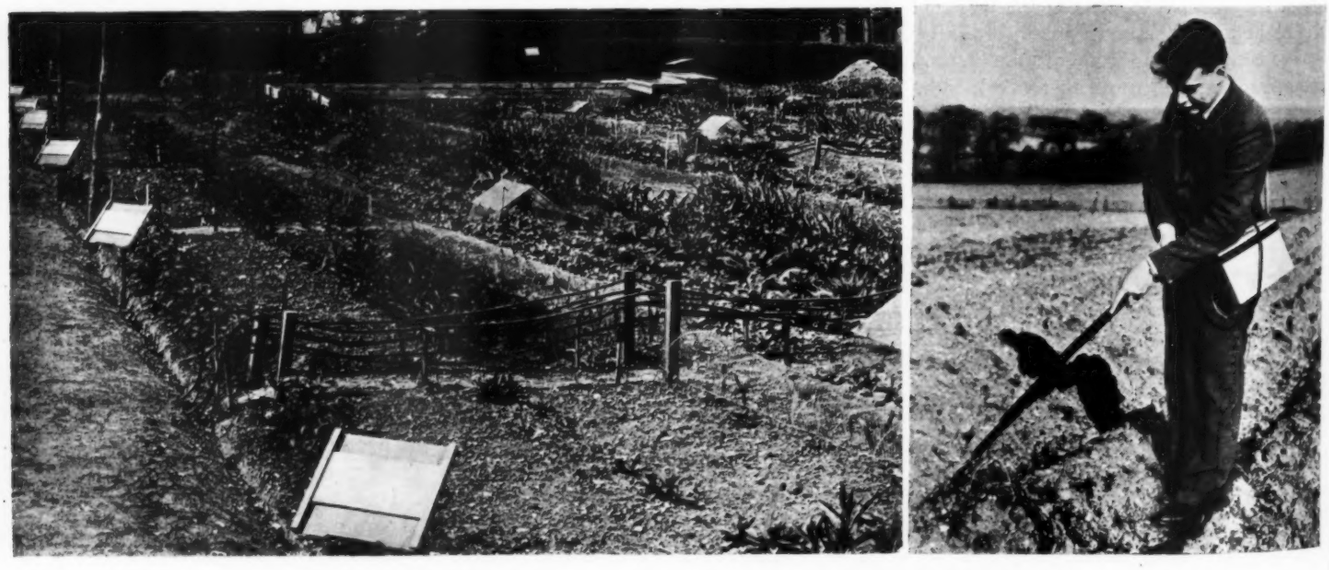
Horticultural plots and glasshouses

The horticultural plots are concerned mainly with soil warming under various conditions. One example was soil warming in open ground. To investigate the economy of this the area had been divided into 18 plots giving six replications of three treatments, compared with similar crops on control plots. The supply is provided through low-voltage transformers.

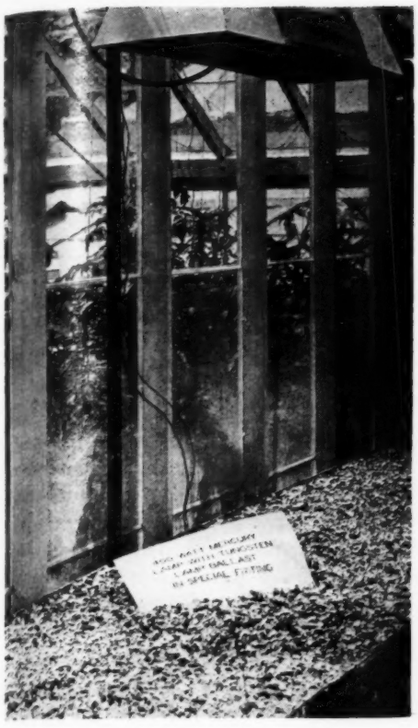
Two of the glasshouses are employed in a small-scale experiment to check the effect of double glazing in reducing heat losses, while a small glasshouse is used for bench experiments on the effect of soil temperature on the growing of plants.

Weedkilling

An interesting investigation is concerned with electrical plant destruction and is divided into the singling of sugar beet and other root crops and the destruction of persistent and deep-rooted weeds. There appears to be considerable promise for the application of these methods to singling crops and a portable apparatus designed for this purpose was on view. The second part of the investigation is still in the



Soil warming in open ground (*left*) and weedkilling electrically (*right*)



This compartment is for propagating purposes. Experiments are being carried out on the use of supplementary artificial light for tomato seedlings, using different light sources

development stage and requires a great deal more work, but it is hoped that it may eventually lead to a practical method of eradicating bracken infestation, particularly on hilly land where mechanical methods cannot be employed.

Pest control

Among the demonstrations was one of the destruction of insect pests infesting stored grain, by high-frequency electric fields. Heat is a sure means of control, but if heat is applied by conventional methods the quality and the germinative power of the grain may be impaired. The application of high-frequency electric fields to the infected material can overcome this difficulty since by this means insects can be heated to destruction without undue temperature rise of the grain. A detailed investigation of the conditions requisite for large-scale application of this high-frequency method of pest control is being made.

Conclusion

The open day must be counted to have been very successful, and provided impressive evidence of the many new directions in which electricity could be utilised in farming practice.

Indian Crop Production Programme

The annual report of the Ministry of Food and Agriculture states that India is aiming at achieving by 1956 a higher level of production in foodgrains, cotton, jute and sugar than ever before. The integrated crop production programme, first announced in 1950-51, has now been merged into the Five-Year Plan, and final estimates available for the first year of working show an increase in production of cotton by 163,000 bales, jute by 1,380,000 bales and sugar by 230,000 tons.

Cotton, jute and sugar

The plan for increasing cotton production, originally drawn up in 1950-51, continued to be implemented during the year under review. Cotton extension schemes are being implemented in 14 cotton-growing States. Interest-free loans up to Rs. 6.3 million were given to State Governments, and about Rs. 1.2 million as subsidy. Production increased from 1,770,000 bales in 1948-49 to 3,130,000 bales in 1951-52.

In respect of jute, the report points out that to maintain the tempo of increased jute production the State Governments concerned were given interest-free loans of Rs. 380,000 and grants totalling Rs. 850,000. Production increased from 2,070,000 bales in 1948-49 to 4,690,000 bales in 1952-53. This leaves a gap of less than 700,000 bales to be bridged within the next three years in fulfilment of the target laid down in the first Five-Year Plan. Measures adopted to increase production include reclamation of waste and fallow lands, double-cropping and intensive cultivation.

The five-year target of 1.5 million tons of sugar laid down in the Five-Year Plan has been achieved four years ahead of schedule. Increased production has enabled the Central Government to relax further controls on sugar produced during 1952-53.

Irrigation and fertilisers

The report refers to the accelerated programme of minor irrigation schemes which have been put into operation. These schemes are capable of being completed within a year or two and will increase food production substantially. Out of an allotment of Rs. 100 million for minor irrigation works for the year, Rs. 25.5 million were desanctioned up to December 31, 1952.

The report says that during the year 370,000 tons of ammonium sulphate were distributed to the State Governments for food and cash crops. The pooled price of this fertiliser has now been reduced to about Rs. 290 per ton. During 1953 about 100,000 tons of fertiliser are to be imported under the Indo-American Technical assistance programme.

During the period January-June 1952, which is the reclamation season, the Central Tractor Organisation ploughed up 235,000 acres of land. Another 14,000 acres of jungle land were cleared in the Naini Tal terai region and made ready for ploughing.

As an experimental measure, a central mechanised farm has been started in Jammu. This farm aims at bringing under cultivation 10,000 acres of land and also aiding in the rehabilitation of displaced persons.

The year 1953 opened with a stock of 1.9 million tons of foodgrains with the Central and State Governments. Crop prospects for 1952-53 are reported to be better than during the last two years. To meet an unprecedented demand for storage accommodation, arrangements were made for storing about 800,000 tons of foodgrains at the capacity of 220,000 tons previously available with the Ministry.

Research and extension

It is pointed out that during the year more than 300 schemes were sponsored by the Indian Council of Agricultural Research and approximately Rs. 4 million have been earmarked for new schemes and for the continuance of some old schemes due to end this year.

The year 1952 saw the beginning of an agricultural extension organisation to carry results of research from the laboratories to the farmers. Pending the formation of a definite scheme of national extension, a sum of Rs. 6.8 million in the 1953-54 Budget has been proposed for extension research and for training village-level workers. During 1952-53 Rs. 2.4 million were provided for agricultural extension work in the country.

Canadian Agricultural Mission

The four-member agricultural and co-operative mission from Canada, a picture of which appeared in our March issue, has arrived in Coimbatore in the course of a tour of India.

The leader of the mission, Mr. Trueman, said that during its tour the mission would collect necessary data to assess the extent and scope of assistance which Canada would give India under the Colombo Plan.

During the last two years, he said, India had been allotted about 28 million dollars under the plan; 37 million dollars more would be made available during the next three years.

South African Crop Prospects

OUR South African correspondent has sent us the following information regarding the outlook for certain crops in the Union of South Africa.

Sugar consumption

If the present rate of sugar consumption in South Africa is maintained, the country will be faced with a permanent sugar scarcity unless production is increased, according to a recent speech by the Minister of Economic Affairs when he opened the Sugar Milling Research Institute in Durban. Sugar production could be increased, he said, by cultivating more land, by developing new types of cane, and by improved milling processes. These results could be secured by study and research and that was why the research institute had been established. Research had already increased the yield per acre from 19.29 tons in 1932 to 26.41 tons in 1951. In the same period milling efficiency had improved from an overall recovery of 75.73% to 83.65%. The local consumption of sugar had greatly increased, partly because of the great influx of natives to the towns and cities, and partly because of the development of industries which used sugar as a raw material. It was estimated that by 1960 the sugar requirement of the Union would be 792,000 tons. Civilian consumption alone would amount to 600,000 tons. To this must be added 200,000 tons a year to enable South Africa to recover her export markets.

Sugar machinery

The Mechanisation Committee of the South African Sugar Association is co-operating closely with the local engineering industry, especially that based on Durban, in developing and modernising old and tried designs for sugar machinery and also in evolving new types. Among new items recently introduced is the Abrahamson trailer, which is also known as the Nkwaleni trailer. This is being manufactured in the Durban workshops of the South African Dorman Long organisation. If the trailer is attached to a slow-speed tractor it can manage 12 loads over a 1-mile haul in the course of an eight-hour day.

Bagasse board

Sir J. L. Hulett and Sons Ltd. are planning to produce board from the bagasse which is at present largely wasted, and a pilot plant is being erected for this purpose. It is believed that the use of bagasse to make hardboard may involve the reconstruction of the existing firing and boiler systems in the company's mills, where up to the present the bagasse has been used for fuel. It seems that for some time to come the other Natal sugar mills will continue to follow this practice, even though it is now being stressed that when the bagasse is used to make board it can be even more valuable than the sugar.

Turkish tobacco crop

The whole of last year's Turkish tobacco crop grown in the Cape Western Province was sold in South Africa, satisfactory prices being obtained. There appeared to be no thought of exporting the tobacco, as the demand in the Union exceeded the supply. The position is said to remain favourable for the growers. Last year, a crop of 1 million lb. was harvested and the indications are that there will be another million lb. crop this year.

Citrus fruit

Reliable estimates of the volume of citrus fruit that will be produced this year for export are not yet available. Several of the citrus-growing districts in the Union have had good rains which should have a beneficial effect on the size and quality of the crop, but yields in parts of the Transvaal may be affected by the long periods of dry weather experienced during the past year.

Maize prospects

This season's maize crop was damaged in a number of important producing areas by drought and intense heat in the early part of the year. In view, however, of the benefit that plantings derived from the widespread rains in February and, as sowings this season were more extensive than usual, it is generally expected that returns will be fair, and unofficial forecasts of a harvest of about 25 million bags have been made. The Union's requirements in maize have risen sharply during the past eight years. In the seasons 1944-45 to 1946-47, annual consumption varied between 20,159,000 bags and 20,946,000 bags, whereas in the three farming years to August 1952, the totals were 26,546,000 bags, 25,520,000 bags, and 28,583,000 bags. Compared with these figures, harvests for the years 1946 to 1951 averaged little more than 25 million bags, and it is becoming evident that the rise in consumption will in future restrict the Union's opportunities for exporting maize. Even when surpluses are obtained as a result of particularly good harvests, they will generally be needed for the maintenance of adequate reserves, as is shown by the present need for imports and the sharp rise in consumption to 28,583,000 bags in 1951-52 when veld pasturage was destroyed by the severe drought. The significance of these trends of maize is emphasised by the fact that imports are expected to cost between £5 million and £6 million.

Apricots, peaches and plums

Exports of apricots in the current season have been completed, and the total shipments reflect a substantial increase over the record established in the previous season. Heavy yields of peaches are also being picked, and deliveries to canners and exports are expected to be much larger than corresponding figures for last season. It is also possible that the final figures for pears and plums will be well above the 1951-52 totals. The apple crop is expected to provide a yield only slightly maller than the 1951-52 harvest. Satisfactory reports also continue to be received on the grape crop, the latest indication being that this season's yield may show an increase of 40% on that for the previous season.

Water conservation

The Secretary for Agriculture, in his introduction to the annual report of his department, has said that farming experience during the year has emphasised the urgency for the general adoption of measures for conserving water and soil in the Union. He reported progress in conservation work, but considered that the adaptation of farming methods and systems suited to natural conditions is the basic principle of soil conservation, and progress here is not as rapid as it should be. He pointed out that conservation farming could not prevent droughts, but by bringing farming systems into harmony with the natural conditions of each region it may relieve the impact of the droughts on the farming industry and considerably influence its economic effect on production.

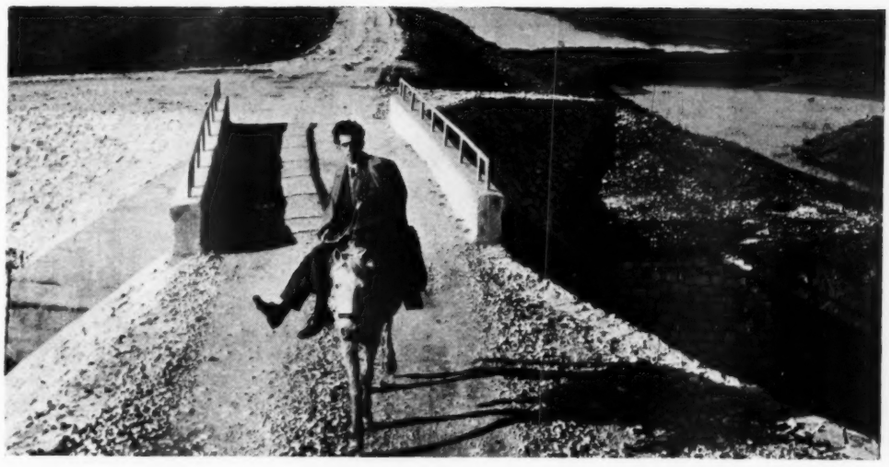
Pakistan Cultivation

The total area of Pakistan under cultivation in 1951-52 was 60,426,000 acres; of this area 22,481,000 acres were under rice, 10,236,000 acres under wheat, 1,779,000 acres under jute, and 3,376,000 acres were under cotton.

Land Reclamation in Greece

ONE of the most dismal and underdeveloped areas in Greece has lately been turned into a flourishing agricultural area, with many new houses and productive farms. Malaria has been brought under control and health conditions improved in the 10,000-acre area covered by a modern drainage and flood-control project in Epirus, in north-west Greece.

A series of levees has been built along the banks of the Acheron and Kokytos Rivers to protect farmland and villages in the Acheron Plain from floods. The 3,000-acre Vouvou and Balteza swamps are being drained. Drainage has already added 1,750 acres to the 7,500 under cultivation in the area. Hundreds of landless farmers will find work and homes in the reclaimed swampland. Some of the 6,000 inhabitants of this remote region, between the Epirus Mountains and the Ionian Sea had never seen a car until the project started in June, 1950.



This small bridge is one of six built as part of the Acheron Plain project. Built on the levee, the bridge spans a drainage ditch. To the left of the curving line of the levee is land now protected from the floods

Scope of the project

Today, the Acheron Plain is an important part of the widespread irrigation and reclamation programme that has been carried out throughout Greece with the help of American funds and technical assistance. Irrigation and reclamation work had begun in Greece before the war, but the country lacked tools and equipment to carry on after the war. About $12 million worth of heavy earth-moving equipment has been brought to Greece by the American Economic Mission, which has contributed the equivalent of $68 million to Greece's reclamation and irrigation programme.

The Acheron project has been carried out with the help of the 10-billion drachma grant provided by the American Economic Mission to Greece. The project has cost the Greek Government about 500 million drachmas so far, and is due to be completed in 1954.

Construction work

About 45 kilometres of levees have been built along the banks of the two rivers and the two swamps. Some 20 kilometres of drains have been excavated, and six small concrete bridges have been built. Earthworks completed amount to 1 million cubic metres. About 6,000 cubic metres of stone masonry have been laid, and 2 kilometres of permanent paved roads and 34 kilometres of unpaved roads have been constructed. The produce of the enlarged farming area can be easily transported to Preveza, Parga, Ioannina and even Piraous. Farm sales are now on an individual basis, but organisation of co-operative outlets is planned when the irrigation district is in full operation.

Part of the Acheron Plain that has been drained to provide new farmland to help Greece meet her food requirements

Crops grown

Wheat, rice, beans, peas and corn have been raised in the area by the most elementary methods. The crop value amounted to 220,000 drachmas per stremma (1 stremma = ¼ acre), but improved cultivation methods taught to the farmers have already raised this to 810,000 drachmas. When the irrigation project is in full operation, crop value is expected to rise to 1 million drachmas per stremma. The Acheron Plain area is divided into 1,110 farms of 25 to 30 stremma each, owned by farmers living in the 18 villages. About 300 farm families are to be settled on the reclaimed land.

Increased production

Since the project began, rice production has increased from 280 to 840 lb. per stremma. Corn yield has gone from 224 to 420 lb. per stremma, and the yield for peas and beans is now 336 lb., twice the previous rate. Such increased production is bringing closer the day when Greece will be self-sufficient. Another 1,000 acres of swampland between the Acheron and Kokytos Rivers, above the present project, are scheduled to be reclaimed in the future.

Pakistan's Foreign Trade

BUT for a temporary export recession during 1952, Pakistan's foreign trade has been expanding since early 1948, and has benefited all sections of the country's population. Pakistan's major exports reached their peak in the first half of 1951. This brought about a considerable improvement in the balance-of-payments position, so much so that in the fiscal year 1950-51 external assets increased from Rs. 856.2 million to Rs. 1,405.6 million.

Pakistan has started 1953 with a favourable trade balance of Rs. 262.7 million on private sea-borne trade during the period January to March: during that quarter exports were valued at Rs. 444.2 million as against imports at Rs. 181.5 million. March, 1953, is the sixth consecutive month in which Pakistan has had a favourable trade balance. During the first nine months of the trade year 1952-53, Pakistan's position on private sea-borne trade account shows a favourable balance of Rs. 280.1 million.

Main exports

The two main cash crops of Pakistan are jute and cotton. An important step taken by the Government was the establishment of the Jute Board at Narayanganj, and the Cotton Board at Karachi. These Boards have been entrusted with the responsibility of regulating, controlling and fostering the production and export of these valuable fibres, which account for nearly 70% of Pakistan's total exports.

Pakistan's exports of jute to the United Kingdom have steadily increased from 17,200 tons in 1947-48 to 109,800 tons in 1951-52. During the first quarter of 1953 Pakistan exported by sea 1,524,705 bales of jute worth Rs. 177.9 million, plus an additonal 257,000 bales over land frontiers Other important exports during the same period were cotton, 554,118 bales worth Rs. 227.3 million; wool, Rs. 12.3 million; hides and skins, Rs. 10.5 million; and tea, Rs. 3 million.

The ban placed in April last year on forward trading in cotton with a view to preventing the possible under-valuation of the new crop by exporters has been lifted. As in the case of jute, price support schemes were introduced, while export duty was reduced by half on all varieties except Comilla and Desi. The total exports of 26,400 tons in 1950-51 to the United Kingdom were the highest since 1947-48, though these fell to 17,000 tons during 1951-52. The official forecast of the 1952-53 Pakistan cotton crop area is 3,430,000 acres with estimated yield at 1,468,000 bales of 392 lb. each. Total exports of raw cotton from Pakistan for the first seven months of this season, namely, September 1952 to March 1953, have nearly reached 1 million bales, which can be regarded as a very satisfactory performance. By March 1 the entire stock of old cotton crop held by the Cotton Board had been cleared through barter deals.

Tea industry

The difficulties of the tea industry have been receiving the earnest attention of the Government. A number of measures have already been taken to ameliorate its condition by improving the financing, storage, and transport of tea. Arrangements have been made for a deferred payment of excise duty against security furnished by the National Bank of Pakistan. Export duty, earlier reduced, and now completely abolished since September 12, 1952, will enable Pakistani tea to compete with teas of similar qualities produced elsewhere. The total export of tea from Pakistan is about 40 million lb. per year, most of which finds its way into the United Kingdom market.

A commodity which was in short supply in Pakistan and has been imported in the past, even from dollar areas, is sugar. Pakistan has established a sugar mill with a capacity of 50,000 tons a year. This is the largest sugar mill in the East. Other smaller units are to be set up in various provinces. When the programme of installation of the sugar mills has been completed, Pakistan will be entirely self-sufficient in sugar.

Development schemes

The significance of the development schemes and their importance to the economy and foreign trade of Pakistan will be appreciated when one takes into consideration the fact that, as the country's manufacturing capacity increases, the complexion of Pakistan's foreign trade is bound to undergo a radical change. For instance, the largest single item imported by Pakistan up to now has been cotton textiles. Under the two-year development programme, it is proposed to set up 11 textile mills with 25,000 spindles each. This is in addition to the 194,000 spindles already installed. Machinery for all the new textile mills has been purchased and when these are in operation Pakistan will become self-sufficient in cotton textiles of coarse and medium qualities. This will naturally reduce Pakistan's imports of cotton textiles to a very large extent, and thus enable the country to save foreign exchange and eventually become independent of foreign sources of supply.

Thus, apart from ensuring adequate supplies of manufactured goods for which indigenous raw materials are available in abundance, the development programme will strengthen the foreign exchange position, not only of Pakistan but of the sterling area as a whole. By the implementation of the development programme, Pakistan will materially increase its industrial and agricultural output, and its capacity to earn foreign exchange will, therefore, also increase proportionately.

The Federation of Agricultural Producers

The farmer's role in world affairs was the theme for the sixth ordinary general meeting of the International Federation of Agricultural Producers which was due to be held in Rome on June 5. More than 300 delegates from over 30 countries were expected to attend the meeting. The conference was held at the headquarters building of the FAO.

Plenary sessions were to be held on the opening and closing days of the meeting, the other days being devoted to committee meetings. Ways of finding stability in world agricultural trade was high on the agenda of the policy committee. Commodity memoranda included detailed reports on wheat, sugar, fertilisers, eggs, cotton, jute, dairy products, sisal and feeds. The activities of international groups on the question of stability of trade in farm products was to be considered, and views exchanged on the Federation's past, present and future position on commodity problems. The Federation in the past has supported international commodity agreements.

A report of the Federation's European committee was also to be considered. It covers the whole field of Europe's agricultural problems, including the organisation of agricultural markets and of international trade between Europe and the other continents. The technical assistance programmes of the United Nations were to be discussed and the Federation's future policy in this field to be considered. A similar discussion was to be held concerning land reform and migration programmes. The I.F.A.P. young farmer exchange programme was also to be discussed. Under this scheme hundreds of farm youths have worked on farms in different countries during the past five years.

The Chelsea Show

Each year the Chelsea Show of the Royal Horticultural Society presents a spectacle which appears to eclipse the efforts of previous years and that presented on the occasion of the one held on May 22 was no exception to this rule.

Both in quantity and quality the floral exhibits in the marquees must be conceded to surpass those which appear at almost any other similar display in any country of the world, while the efforts of the plant breeders in the service of nurserymen in producing new and startlingly beautiful varieties of familiar flowers must ever be a source of wonder and amazement.

It would be invidious to single out for special praise any particular class of exhibit, but the exceptional and striking exhibits in the classes for orchids call for special mention as well as the displays of certain tropical ornamental plants.

A feature of the present show was the remarkable exhibit organised by the Royal Botanic Gardens, Kew, at the request of the Royal Horticultural Society to illustrate the native flora of the various parts of the British Commonwealth, as an appropriate mark of the coronation of H.M. The Queen, who is patron of the Society. The exhibit included representative plants of the flora of all the Dominions as well as of the majority of the Colonial Dependencies, and many noteworthy and interesting forms.

Outside the marquees, in the grounds of Chelsea's famous Royal Hospital, there appeared the customary displays of formal and rock and water gardens which on this occasion were even more elaborate and beautiful than in past years, one noteworthy feature being the considerably more extensive use of water made in many of these displays. It was indeed a matter for remark how the exhibitors had managed to impart such an air of settled and mature development to exhibits which at best could have been only in the nature of ephemeral efforts.

The range of commercial exhibits and of horticultural and garden implements and requisites was once more very wide and representative. Small garden tractors were well to the fore, the machines exhibited including the Howard Rotovator shown by Rotary Hoes, the M.G. tractors and equipment shown by Ransomes, Sims and Jeffries, and the Colwood tractors and attachments shown by Dashwood Engineering Ltd.

Numerous exhibits also appeared in the section devoted to crop protection products and machinery, firms represented including Plant Protection Ltd., the Murphy Chemical Co., Pan Britannica Industries and Four Oaks Spraying Machinery Ltd.

The scientific section included exhibits from Long Ashton, East Malling, Rothamsted, Cheshunt, Reading University, and the Royal Horticultural Society's experiment stations as well as from those operated by Plant Protection Ltd., and Messrs. F. W. Berk and Co. at Tilgate ; in addition, there were exhibits by the Shell Photographic Unit and Messrs. Sutton and Sons.

The attendances were very large, and although the show always attracts many visitors, on this occasion they appeared to be even more numerous than usual.

Fifteen graduates of the Agricultural College of Norway at Oslo, visiting David Brown Tractors Ltd., at Huddersfield. The students were on a fortnight's study of British agriculture

Irish Milling Order

The Wheat Milling Order, 1953, which has been issued in Eire is a first step towards abolishing the system of control which the world shortage and high price of wheat forced the Government to impose on flour millers soon after the outbreak of the war. The Order does not affect the existing provision for subsidising flour prices, but when it becomes operative, the existing method of distributing whatever amount may be provided by way of subsidy will be changed. The changes will be merely changes in machinery. The government's purpose is to reduce to a minimum the amount of State interference with the flour-milling industry, while maintaining the general character and structure of the milling organisation which was built up under the protection of the Cereals Acts.

The Indian Jute Research Institute

Shri R. A. Kidwai, the Indian Minister for Food and Agriculture, laid the foundation stone of the Jute Agricultural Research Institute at Barrackpore on February 9. In his introductory address, Shri K. R. Damle, the president of the Indian Central Jute Committee, traced the working of the committee and the institute which was originally established at Dacca in 1938. With the partition of the country, four-fifths of the total area under jute went over to Pakistan, while all the jute mills were situated in India. To solve the problem of providing raw jute to keep the mills going, the nucleus of an institute was set up in 1948 in a rented house at Hooghly with a 50-acre farm at Chinsurah. This makeshift arrangement, however, came to an end when 104 acres of land were presented by the West Bengal Government to the committee for establishing the institute on a permanent footing.

Important results of practical value obtained at the institute include evolution of improved jute strains and the development of a labour-saving jute seed drill. Encouraging results have also been obtained in row cropping and double cropping and jute manuring experiments conducted at the Institute.

Research has also been conducted on physiological and anatomical studies, control of diseases and pests, seed storage and retting of jute fibre.

(*From ' Indian Farming.'*)

RESEARCH DEVELOPMENTS

Some New Patents

A new spraying technique

Crop spraying is hedged about with difficulty: old style high-volume spraying is on the way out because of the trouble and expense of transporting the huge quantities of water necessary and because heavy spray machines churn up the surface of the soil. To overcome these drawbacks conventional low-volume gear was introduced, using perhaps as little as 5 to 10 gal. per acre and relying on fine atomisation to provide the necessary coverage.

As a variant, air blast apparatus swept the atomised insecticide in jets of fast moving air over and through the crop. Even so, however, new drawbacks arose. Often the insecticide did not reach the lower surfaces of leaves and the efficiency of treatments was reduced by winds blowing the pesticide away from the plants. Spray drift can be a serious risk, since insect poisons may contaminate nearby pastures and maturing human food crops, while drifts of hormone type weed-killers can ruin adjacent broadleaf crops.

Bayer Farbenfabriken of Leverkusen, Germany, have recently patented a means of overcoming some of the difficulties in low-volume spraying, which assures 'an even distribution of insecticide without wind loss.' Using conventional components, a jet of air is directed near the crop either horizontally, or obliquely downwards: the insecticide is atomised into the jet of air so that mixing occurs outside the machine.

Because emission takes place at crop level and due to the air jets' agitating effect on the leaves, both leaf surfaces are dosed adequately while casual wind currents have no effects on the movement of the atomised pesticide.

This patent provided no data on capacities, working speeds or pressures, but concentrated upon this new departure in spray technique. (British Patent 685,211, dated December 31, 1953.)

Coated insecticides

Much interest centres around the need to protect beneficial insects from the effects of spray chemicals; one British firm has taken the lead in this matter by popularising the concept of 'selective' insecticides. Despite the protests of some research workers, many practical men agree that beneficial insects often cannot by themselves afford adequate protection to crops and that ultimately selective insecticides must in all probability carry the day.

Recently, Pest Control Ltd., has patented the proposal to coat insecticidal powders with cellulose or alginates, and this may prove an important and further step towards minimising the risk of killing predators. Wettable powders prepared in this way have no contact efficiency, but the aim is to kill biting insects, especially caterpillars which devour foliage.

Leaf-eating insects have enzymes which digest cellulose in an alkaline medium within the alimentary canal; by contrast predatory insects carry enzymes which digest protein and fats in a predominately acid medium. Thus in the case of the cellulose-coated powder grains only the pests will be able to digest away the protective layer and liberate the poison. With the alginate-coated particles the release mechanism is somewhat different. Alginic acid is weakly acidic and dissolves readily only in slightly alkaline solutions, thus the acid gut-juices of the predatory insects will not dissolve away the coating to the insecticide particle although when they meet the alkaline juices within a caterpillar's alimentary canal this protective coating will dissolve with the consequent release of the poison. (British Patent 673,166, dated June 4, 1952.)

A new sticker for copper fungicides

Soluble copper fungicides such as Bordeaux or Burgundy mixtures can occasionally cause foliage damage and, for some purposes at least, cuprous oxide or copper oxychloride are replacing the older materials.

Both the oxide and the oxychloride are insoluble, so for the purposes of spray application they are ground to a particle size passing 100 to 150 B.S. mesh and suspended in the spray-wash.

One difficulty though is the fact that particles tend to leach off leaf surfaces and have to be 'stuck' on; the stickers for this purpose may be blood albumen, skimmilk, gelatin or most commonly size. Neither size nor gelatin are easy things to get into cold water solution and to break this difficulty Pest Control Ltd. has proposed a novel method.

Essentially following the old rule that small particles dissolve easily, Pest Control chemists spray-dried gelatin solutions and ground the dry matter to pass 150 B.S. mesh. When added at the rate of 1 lb. per 100 gal. of spray-wash this sticker very readily dissolved. They also found that the copper particles might be coated with gelatin and that the resultant dry powder was easy to mix with water.

Details are given for preparing coated copper fungicide: 5 lb. of the oxychloride are suspended in a gallon of water, to this is added ½ lb. gelatin dissolved in hot water, and ½ lb. of sodium tripolyphosphate added. The suspension is dried over steam-heated rollers and reduced to pass the standard mesh sizes.

Both the copper/gelatin mix and the gelatin-coated copper grains are claimed to take up and disperse in water better than materials prepared by other means. (British Patent 685,127, dated December 31, 1952.)

Improved smoke canister

As a labour-saving alternative to crop spraying in commercial glasshouses, British growers find the use of 'smoke canisters' a convenient method of insect control. Basically, the construction of these canisters is simple: the insecticide adsorbed on to an inert dust is mixed with the 'burning' substance which commonly consists of lactose sugar and either nitre or potassium chlorate.

The burning mixture is ignited and the heat of combustion vaporises the pesticide; during this ignition some of the toxin is destroyed and this loss of insecticide became particularly apparent when attempts were made to disperse phosphorous insecticides by this means.

J. L. Walpole, 'smokes' chemist working for the Murphy Chemical Company Ltd., found he could reduce insecticide losses by isolating the pesticide from the burning mixture. As patented, the insecticide, adsorbed on an inert base, is enclosed within containers which are destructible and may be made of gelatin, cellulose acetate or glass. These small containers are embedded one or more at a time in the burning mixture which additionally contains a vapourisable substance which may or may not be insecticidal. This vapourisable material reduces the risk of the outer container bursting or spilling when the contents are hot and have swollen.

Materials suitable for use in the inner capsules are claimed to be chlordane, TEPP, HETP, Parathion, nicotine, thiophosphates and lethane type substances. A feature of construction is the inclusion of a baffle plate immediately above the chemical contents; this baffle a short distance below the mouth of the canister assists in the proper mixture of the gases as they issue forth. (British patent 663,950, dated January 2, 1952.)

ALAN GOODMAN.

NEW BOOKS

British Grasslands

By T. Bedford Franklin. Pp. 173, illustrated. Faber and Faber. 1953. 21s.

In this book, the author has attempted to review the history and the development of grassland in the United Kingdom, from the earliest time down to the present day, and to include an account of modern methods adopted in pasture management. He has succeeded in producing a very interesting and intriguing work. His account of the development of the earliest meadows in Anglo-Saxon times makes fascinating reading, as does Chapter 4 in which an account is given of the development of shielings. Next follows, in Chapter 5, an account of the Domesday pastures and the development of the marsh pastures. In the successive chapters, developments in Norman, Plantagenet and Tudor times are traced and the gradual evolution of the sown pastures. Chapter 11 discusses the development of enclosures, while Chapter 12 discusses the Midland fattening pastures. The remainder of the book is given up to discussing pasture management and the ideas which have emerged as the result of modern research, including the work of the Northumbrian School at Cockle Park and the Welsh Plant Breeding Station.

Soil Restoration

By Edward H. Faulkner, with a foreword by S. Graham Brade Birks. Pp. 207. Michael Joseph Ltd., London. 1953. 10s. 6d.

Mr. Faulkner is well known as the author of two previous works, *Ploughman's Folly* and *Ploughing in Prejudices*, in which he challenged a number of ideas formerly widely accepted in regard to the value and use of the plough in agriculture; some of his ideas have received endorsement and confirmation in recent scientific work on both sides of the Atlantic. In this book, he gives the results of seven years' experience of putting his ideas into practice on a farm he purchased, mainly directed to the problem of restoring the condition and fertility of soils which have been run down and depleted of fertility by many years of unsatisfactory management.

Mr. Faulkner writes as a practising farmer and his book is very far removed from a dispassionate account of a series of objective experimental studies; indeed, one rather suspects that Mr. Faulkner may regard the scientific method with a certain degree of disrespect, which, as Dr. Brade Birks points out in his introduction, may hardly be justified. Mr. Faulkner is blessed with a certain facility of style in writing which at times he uses with excellent effect. He is throughout essentially colloquial, and his discourse is enlivened by frequent reference to a certain Zeb Turner, whose role it seems to be to serve as a sort of agricultural Dr. Watson to the observations of the author.

It cannot be said that Mr. Faulkner's recommendations and observations have anything startlingly new about them; he pins his faith to the old and well-tried methods of former generations of farmers and is obviously impressed by the merits of that classic work of the late Prof. F. E. King, *Farmers of Forty Centuries*, which described the methods of Chinese agriculturists. He is greatly impressed with the merits of organic manures, and although he certainly does not appear to subscribe to some of the more extreme views of what has become known in the U.K. as the ' muck and mystery ' school, there is strong endorsement of what, in any case is accepted by the main body of scientific opinion, as sound practice.

To those who are in search of a readable and racily written work devoid of technicalities, which does not pretend to provide an objective study of results, but which nevertheless contains an underlying substratum of sound observation, deduction and horse sense, the book can be commended.

H.T.

A Textbook of West African Agriculture (Soils and Crops)

By F. R. Irvine. 2nd edition. Pp. 367, illustrated. Geoffrey Cumberlege, Oxford University Press, London. 1953. 14s.

The first edition of Dr. F. R. Irvine's well-known work on West African agriculture appeared in 1934 and the lapse of time has called for a second edition. The opportunity has been taken of making a number of additions to the earlier work and of bringing it up to date. The book comprises nine general chapters dealing with such matters as soil formation and composition and the various operations and implements used in agriculture as conducted in West Africa, while the latter part of the book is given up to the consideration of the principal crops grown, chapters on propagation of plants, plant disease, insect pests, school gardening, and so forth, and an addendum comprising information on points omitted from and which have arisen since the first edition. The book itself is well written, dealing with West Africa, where there is little or no estate cultivation ; it is mainly concerned with peasant agriculture. For those who require a guide to the outstanding feature of West Africa, it can be cordially commended Taken in conjunction with the earlier book by Faulkner and Mackie, bearing the same title, it gives an excellent picture of the overall agricultural conditions in that part of the world. The book is well illustrated with some 32 plates of photographs of various aspects of West African agriculture. The price it is now offered at, bearing in mind the great rises that have taken place in all published works, is extremely reasonable.

H.T.

Materiae Vegetabiles

Vol. I, No. 1. Edited by C. Begel and Fr. Tobler. The Hague. 1952.

This is the first number of a new quarterly periodical which, to quote from the introduction, is ' to be dedicated to the whole domain of vegetable raw materials.' It aims at being a connecting link between research on the utilisation of such materials.

Judging from the contents of the first issue, it should serve a useful end. The articles are all written by recognised authorities and cover a wide range of subjects, as, for example, ' The Nutritive Value of the Vegetation of the Karoo Veld in South Africa,' by Miss Henrici of Fauresmith, O.F.S.; ' The Caesalpinias as Tanning Materials,' by Dr. F. N. Howes of Kew; ' The Extraction of Rosin from Conifers,' by Dr. Karl Mazek Fialla of Vienna; ' The Significance of Terpene Accumulations in Plants,' by Mr. F. C. Riches of Cambridge, and a number of other communications.

The quality of the papers as well as the manner of presentation of the journal should ensure its welcome. We wish it every success.

Massey-Harris Annual

We have received a copy of the *Massey-Harris Farmers' Annual*, which we understand was sent out to over 4,000 British farmers in the early months of this present year. The book is an extremely well got-up production and contains a number of articles by well-known authorities, including the Rt. Hon. Walter Elliot on the ' Future of Farming,' Sir James Scott-Watson in an article entitled ' Towards Higher Yields,' Major T. K. Jeans on ' Silage and Dried Grass,' and W. H. Cashmore on the ' National Institute of Agricultural Engineering ' as well as 15 other articles all by recognised authorities in their own line. The book is illustrated by a large number of reproductions of photographs as well as by seven reproductions in colour.

Reports and Publications from FAO

The following are among a series of reports recently received from the Food and Agriculture Organisation of the United Nations :

The Output and Expenses of Agriculture in Some European Countries

This is a study prepared by the Agricultural Division of ECA and FAO as a mimeographed document. It is mainly concerned with basic data essential to the solution of the problem of the production of more food of the right kind as cheaply as possible. The countries included in the study are Belgium, France, Ireland, Luxemburg, Netherlands, Switzerland, United Kingdom, Denmark, Finland, Norway, Sweden, Western Germany, Greece and Italy. The study is divided into two parts: In Part 1 the main features brought to light by examination of the detailed statistics of the individual countries are compared and described, while in Part 2 the situation in each country is analysed with more regard to detail. To persons seeking information on the conditions of production in the various European countries this compilation will be found invaluable.

Proposals for a World Food Board

This is a reprint of a proposal, first put forward to the General Assembly of FAO in 1946, for the formation of a World Food Board and the increasing of food production and supplies to meet the requirements of consumers throughout the world. The document deals with the nature of the problems, inter-relationship of nutrition and agriculture with industry and trade, the development of purchasing power, and the possible form of organisation and structure and functions of the suggested World Food Board.

Report of the Third Meeting of the Working Party on Rice Breeding (FAO Development Paper No. 30)

This bulletin is a report of the Third Rice Meeting held in Java in May 1953. The bulletin summarises the recommendation of the meeting. These included proposals for undertaking back-crossing of the more sterile F^1 plants; the need for further information on the factors determining sterility of certain *indica-japonica* combinations and particularly the necessity for undertaking the cytogenic studies in this connection. It also recommended that the possibility of growing two crops of rice on the same field should be explored, and that all governments should explore the possibility of short-courses for training junior assistants and also for taking steps to rectify the unsatisfactory position of seed multiplication and distribution.

Water Laws in Italy (FAO Development Paper No. 22)

This contains a summary of the water laws in Italy and indicates the part they have played in fulfilling the firm legislation of the country. The climate of Italy is such that irrigation is bound to play a considerable part in the agriculture of the country.

Equipment for the Ginning of Cotton (FAO Development Paper No. 25)

This paper is one of a number dealing with the processing of agricultural products dealt with by FAO, including descriptions of machines and other equipment used in the ginning of cotton. Detailed specifications of machines and equipment are not included. Should operational details of this nature be required, they can be made available by FAO on request. The invention of the cotton gin in 1793 was probably the most important event in the development of the cotton industry, and the new cotton gins made possible the production of large quantities of cotton to be spun into yarn, which is strong enough to serve as warp and weft in weaving. The compilation of the paper is intended for the guidance of agricultural readers interested in improving the facilities for ginning seed cotton in cotton-producing countries.

European Timber Trends and Prospects

This is a work of some 315 pages in length and it comprises a study prepared jointly by the Food and Agriculture Organisation and the United Nations Economic Commission for Europe. It was undertaken primarily to find answers to the question of whether the achievement and maintenance of equilibrium between demands and supply of timbers in Europe would require international collaboration or whether it was likely to be achieved automatically. The study is intended to appraise these problems and attempts to bring together material which had not been assembled before. It comprises three parts, the first of which is concerned with consumption and which discusses at length the various uses for wood and the demands for it. Part 2 is concerned with production and includes a survey of forest resources and the production of various kinds and types of timber. Part 3 discusses international trade in timber and trade prospects. The fourth part is concerned with a summary of what has gone before and reviews past trends and future prospects. The work is the result of a stupendous amount of labour and contains information invaluable to all concerned with problems of timber supply in Europe.

FAO Yearbook of Food and Agricultural Statistics for 1952

This is the issue for 1952 of the yearbook of agricultural statistics of production of all the more important crop products, together with notes on the more important commodities. As a work of reference it is a further advance on its predecessor and is invaluable to the agricultural specialist.

FAO Yearbook of Forest Products Statistics for 1952

This book, like earlier volumes, is essential to all interested in timber production.

Raw Materials for More Paper

The purpose of this book is twofold, it reviews the present position in regard to current practice in the various pulp processes for paper making and the materials available, and secondly describes pulping procedures in a manner which will allow comparisons to be made of results obtained in different laboratories. There is a considerable need for increased supplies of pulp and paper to keep pace with growing demands, and some of the technical processes available for the manufacture of pulp from fibres are not utilised. There is sufficient economic promise to warrant the thorough examination of the possibilities of producing wood pulp in the tropics. Suitable processes are available and some are already in use. The development of a pulp and paper industry in the tropics could take place, but its growth must be accompanied by intensified and accelerated research. The second part is concerned with procedures recommended for investigating new fibrous raw materials for paper making. The book itself is an important new production which should be of considerable use to those engaged in developing new sources of supply of these important materials.

These can be obtained direct from FAO, Viale delle Terme di Caracalla, Rome, or through H.M.S.O., London, or Leonard Hill Ltd., Stratford House, 9 Eden Street, London, N.W.1.

Publications Received

An Economic Survey of the Colonial Territories—Vol. IV, The West Indian and American Territories

This is Volume IV of the Economic Survey of the Colonial Territories recently issued by H.M.S.O. It is the continuation of the work formerly issued annually in one volume. This particular volume deals with the West Indian and American territories and includes comprehensive information on all of these. Like its predecessor and the other volumes in the present series, it will be found invaluable by all seeking information on questions relating to these particular territories. The territories treated include Barbados, British Guiana, British Honduras, Jamaica, Leeward Islands, Trinidad and Tobago, Windward Islands with the Bahamas, Bermuda and the Falkland Islands.

The Report of the Tea Research Institute of East Africa for the Year 1951

This is the first published report of this organisation. The institute is situated at Kericho in Kenya. It is incorporated in Kenya as a company without share capital and is supported by contributions from the funds of the East Africa Central Tea Committee. Its object is to provide research facilities to the territories of Kenya, Uganda and Tanganyika. It is controlled by a governing body, the members of which are appointed by the respective tea boards. The director is Dr. T. Eden, late of the Ceylon Tea Research Institute. The research work is at present concerned mainly with experiments to obtain information about responses of tea to nutrients in East Africa, investigating techniques for vegetative propagation of tea and with the tannin content of East African teas. The high reputation obtained by Dr. Eden in Ceylon is sufficient guarantee that the station has before it a career of considerable utility.

Department of Agriculture, Jamaica. Investigations 1950-51

This is a summarised account of the principal investigations carried out at the experiment stations of the Department of Agriculture in Jamaica. They cover agricultural chemistry, animal industry, dairying, entomology, field crops, forage crops, plant pathology, soils and fertilisers, veterinary science and poultry husbandry.

Annual Report of the Department of Agriculture, Jamaica

This is the annual report for 1951 of the Department of Agriculture, Jamaica. The first section is concerned with a general review of agriculture in the colony. Weather conditions were unusual, rainfall being below normal in the earlier part of the year followed by a disastrous hurricane and torrential rain in August, which did severe damage to bananas and coconuts. A feature was the continued drift of agricultural labour from the land and the steady expansion of mechanisation. The money value of export crops increased, although the volume of exports showed some decrease. The total value of exports amounted to nearly £17 million. The recovery of the banana industry was much retarded by the hurricane which also affected production of many other crops. The most important departmental development was the integration of the extension staff, formerly attached to the Jamaica Agricultural Society, with the staff of the Department of Agriculture.

Annual Report of the Department of Agriculture, Cyprus, for 1951

This includes a series of separate reports on various aspects of agriculture research, *i.e.* entomology, chemistry, as well as one on soil conservation.

Pakistan Wheat Shortage

Dr. Harry Reed, leader of the American wheat mission which has been touring Pakistan, said recently that there was no doubt that there would be a deficit of wheat in that country this year.

Pakistan has asked the United States for the loan of 1 million tons of wheat to avoid widespread distress, and the mission's job has been to prepare a first-hand report for the United States Administration. The shortage of rain in the last two seasons was the main cause of the wheat shortage.

WORLD CROPS

OUR NEXT ISSUE will include an article on **The Queensland Cotton Crop** by L. T. Sardone. **Spraying Nozzles** will be described by R. J. Courshee and **Green Manuring in India and Pakistan** discussed by Dr. C. de Fellner. There will also be additional articles besides the regular features.

Wheat Growing Areas in Australia

With reference to the map of the wheat-growing areas in Australia in relation to rainfall published on page 77 of the February 1953 issue, we have received from Mr. E. J. Donath, Senior Tutor in Economic Geography, University of Melbourne, a letter pointing out that the map in question contains a number of errors. This map was supplied to us by Mr. L. T. Sardone, the author of the article on 'The Australian Wheat Crop' which appeared in the preceding issue of WORLD CROPS. We took this matter up with Mr. Sardone who has since been in touch with Mr. Donath. Mr. Sardone quotes the source from which he obtained the map and states that it was intended to show, in a general way, the Australian wheat belt, whereas Mr. Donath probably feels that a more detailed and particularised map should have been used. Mr. Donath points out that on the map in question the isohyets are given wrongly, whether they are given annually or for a growing period. Wheat in commercial quantities is not grown so near to Melbourne. The wheat belt in Western Australia and Queensland is wrongly indicated. No wheat is grown in New South Wales with less than 10 in. of annual rainfall, and Brisbane's rainfall is not less than 20 in.

Phenoxylene Milestone Reached

The sales of Phenoxylene 30, the M.C.P.A. hormone-type weedkiller made by Pest Control Ltd., have now reached the 2 million gal. mark in the United Kingdom. The two millionth gallon was actually sold to a Yorkshire farmer who was entertained and presented with a silver cup by the company to mark the occasion.

Phenoxylene 30 is used for controlling weeds in corn, notably charlock, corn buttercup, docks and thistles, and the sale of 2 million gallons represents about 4 million acres treated, giving, at a conservative estimate, an increased yield of the equivalent of 800,000 tons of wheat.

Ministry of Agriculture Exhibits

At county agricultural shows in the eastern counties of England this year the exhibit of the Ministry of Agriculture will feature the effects of liming the soil and the advance of the aphid, as well as illustrating the damage caused by eelworms particularly to crops of potatoes and beet.

FARM MACHINERY

Machinery at the Royal Show

AS in previous years we are devoting part of this section to the machinery and equipment at the Royal Show, which is being held this year at Blackpool. We give below a selection of accounts of some of the many products which will be on show.

Among the exhibits of the **Catchpole Engineering Co. Ltd.** will be the Shotbolt potato harvester. It is said to give complete separation of the clods and stones from the potatoes and positive disposal of the haulms. The potatoes, clods and stones are passed through a separating tank containing a suspension of earth in water and insofar as the potatoes float and clods and stones sink to the bottom, complete separation is achieved. The potatoes are delivered into a trailer travelling alongside and the clods and stones are taken up an elevator and put back on to the ground. A blowing fan gives an air stream under the chains, removing the haulm and rubbish, which is induced into a tunnel and delivered on to the ground behind the machine. This company will also be showing among other machines a sugar beet harvester and a sugar beet seed drill.

Geo. W. King Ltd. will be exhibiting a comprehensive range of pneumatic grain conveying equipment, grain driers and conditioners, precast concrete greenhouses, garden frames, piggery equipment, fencing posts and a wide range of other equipment.

J. S. Ramsbottom (Kirkham), Ltd., the Lancashire main dealer of **Rotary Hoes Ltd.** will be showing the full Rotavator range. The exhibits will include the Platypus tractor, the Howard Trailing Rotavator, various mounted Rotavators and the Rotavator Gem and Bantam.

Among the equipment to be shown by **Christy and Norris Ltd.,** who specialise in disintegrating and pulverising machines, will be the Essex Major hammer mill and a range of Briton grinders. The principle employed in the latter is simply that beaters revolving at a high speed inside the machine pulverise any material fed into it. The powder thus produced is drawn through the regulating screens which form the periphery of the grinding chamber and blown into the collecting cyclone. The beaters, of alloy steel and of the swinging type, are held in place by transverse beater pins. The screens are of perforated steel plate, of mesh and thickness to suit the work to be done, and in most sizes they extend for three-quarters of the periphery.

In addition to the wide range hitherto exhibited, **Cooper, Pegler and Co. Ltd.** is to show the Super-Knapsack sprayer, high pressure (75 lb.) piston pump of a new design; the Rex 2-3-4-jet lance, adapted for high or low volume weed spraying; the Eclair tractor mounted low volume weed sprayer which is fitted with diaphragm pumps; the Cooper Pegler hand-power low-volume weed sprayer which is stated to be ideal for the smaller farmer; the Toxaver small power duster, made either as a stretcher model, or can be fitted with one wheel and push handles if desired; and the Pulvover large power duster fitted with 10 nozzle boom for crop dusting, or available with single flexible lance for rubber, tea and the like.

The International Harvester Co. of Great Britain Ltd. is as usual showing a wide range of its products, including the B-3-R bale loader, B-9-A disc harrow, B-R green crop loader, B-200 manure spreader, B-200 mounted plough, F-5-A fertiliser distributor, F-7-R binder and the B-64 harvester thresher.

E. Allman and Co. Ltd. will be showing its Genimec twin spray rig which can be supplied to fit the hydraulic lift of all the popular makes of tractors. It is stated to have an operating pressure up to 100 p.s.i. according to the size of jets being used and it can apply from 2½ to 75 gal. per acre. The company will also be exhibiting its new Model 100 which is of 100 gal. capacity and which can be used either hydraulically mounted or as a trailer. It will be offered in the following spraying widths: 20, 30, 48 and 96 ft. and will have a working pressure from 10 to 300 p.s.i. There will also be the firm's usual range of spraying and dusting machinery.

The Genimec twin spray rig which has an operating pressure up to 100 p.s.i.

Among the new machines to be shown by **Salopian Engineers Ltd.** is the improved E.T. baler which is similar to the Model T.P. but powered by an 8-h.p. Armstrong Siddeley, air-cooled, Diesel engine. It is stated that certain improve-

The Shotbolt potato harvester which is said to give complete separation of the clods and stones from the potatoes

ments and new design trends are to be seen in the company's Hyperion and Polydisc ploughs. The newest machine, however, is the Cheshire trench digger, a small machine which is said to be capable of digging a trench of 30 in. deep and 6 in. wide in one operation at the rate of 3 to 4 ft. per min.

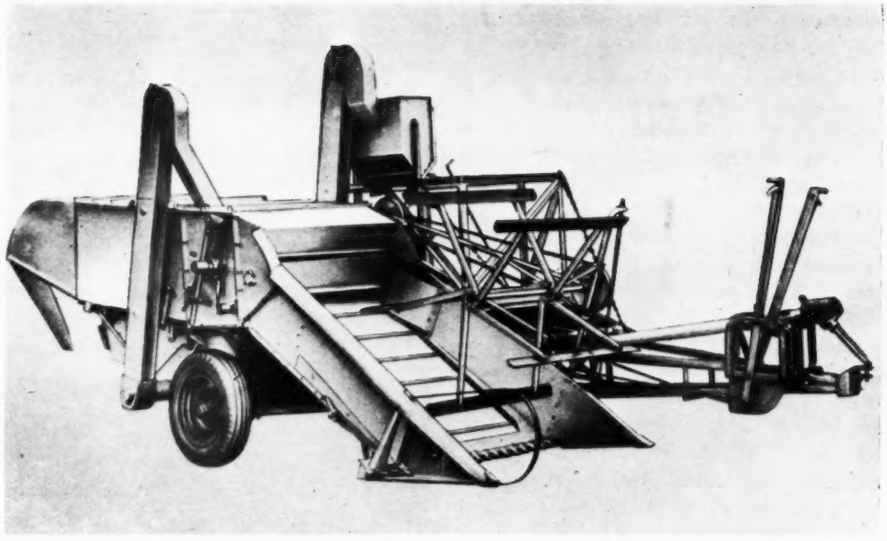
The **Ford Motor Co. Ltd.** will be exhibiting 10 different versions of the Fordson Major. The only modification to the tractor since last year is the inclusion of a hand brake. A range of implements will also be on view, including the Fordson 3-row ridger, the spring tine cultivator and the F-R T.S. 63 semi-digger plough.

Ransomes, Sims and Jeffries Ltd. will have a wide range of equipment on show, including an export section. At the latter, a 30-in. power peanut sheller; a 4-furrow Hussar TD. 12 disc plough; a 4-furrow Proconsul TS.3.H. tractor plough; a C.M.1 tractor cultivator with nine tines; a TD.16 mounted reversible disc plough and a TD.17 mounted disc plough will be on view. On the general stand will be seen a range of ploughs, toolbar frames, disc harrows and other farm equipment.

Pan Britannica Industries Ltd., manufacturers of fertilisers and insecticides, will be showing a range of horticultural products, also the Microsol 202 Generator method of aerosol application.

Two new products, an air-cooled engine and a 4-in. water pump, are to be shown by the **Wolseley Sheep Shearing Machine Co. Ltd.,** besides other equipment. The air-cooled engine is a 4-stroke model of 1½ to 5 h.p. and can be operated on petrol or petrol/vaporising oil. The conversion to vaporising oil operation is said to be quite simple, there being no need for a vaporiser. The speed is variable, 600 to 1,500 r.p.m. An unusual feature is the availability of a drive at either end. The new 4-in. pump unit is claimed to give a remarkable performance for a 5-h.p. unit as it will deliver up to 2 tons of water per min. at low heads and is capable of covering one acre of land with 1 in. of water in less than an hour.

A wide range of spraying machinery is to be shown by **Drake and Fletcher Ltd.** Among the new machines which are being exhibited this year are the Mistejecta, and the Dustejecta II. The former sprays both liquid and powder to great heights in rubber and over wide areas of tea and paddy plantations, etc., and is used also for locust control. It is made in two sections for easy transportation over rough country by hand or wheeled transport. The Dusejecta II is an improved Dustejecta for powdering rubber and coconut plantations, tea and the like. Lighter than the original, this new model incorporates a new patented aeration form of agitation giving an even flow of powder. It can now be carried by only two men instead of four.



Combine harvester which is being shown by Ransomes, Sims and Jeffries Ltd.

The suction attachment for the Tornado pneumatic grain conveyor (which has been awarded the silver medal at the Dublin Show this year) will be exhibited by **Mitchell, Colman and Co. Ltd.** The patented innovation with which the Tornado fan is capable of sucking grain up from the bulk and then depositing this into the hopper without bringing the grain into contact with the fan, is based on the separation of grain and air by inertia. As the Tornado can also be fitted with a heater battery to dry and condition grain by ventilation, this is felt to be a truly compact unit where all conveying and drying operations can be carried out by the fan and motive power unit. A forage blower, for the elevating of silage and other wet materials, is also to be shown by this company, The machine shown has a 9 ft. long table for the auger which feeds the material into the blower from where it is then elevated up to 60 ft. height.

A multiple transmission handbrake is now being fitted as standard on current production of the Fordson Major tractor

The Four Oaks Spraying Machine Co. Ltd. is to exhibit its tractor mounted unit at the Royal Show for the first time. The tractor unit all purpose sprayer is said to provide the most efficient and most economical method of spraying crops, including potatoes, wheat and grasslands. The spraying width is approximately 20 ft. and the beam 18 ft. There are two booms each 9 ft. long. Each boom may be turned on or off from the tractor seat. Each boom may be raised or lowered from the tractor seat, and if a boom meets an obstruction, it will swing back and return automatically to the spraying position.

Among the equipment to be shown by **Jack Olding and Co. Ltd.** is the new Unidresser grain and seed cleaner which has been produced for the farmer who requires a relatively small grain or seed cleaning installation with a moderate outlay, capable of producing a good commercial sample. The company is also showing the Vickers VR-180 tractor which is said to incorporate many major features in tractor design.

Edward Curran Engineering Ltd. will be showing the Slade Curran crop drier ; the Hosier-Curran grain drier ; the Hosier - Curran milk recorder for fitting to milk machines ; the Hosier-Curran gate ; and the Hosier-Bomford reversible plough.

Among the equipment shown by **Dorman Sprayer Co. Ltd.** will be the Dorman 250-gal. high/low volume crop sprayer which has been designed to handle all commercial weed killers, insecticides and fungicides (not sulphuric acid and copper chloride) at high or low volume rates of application ranging from 10 to 100 gallons per acre. The company will also be showing the Dorman 150-gal. high/low volume crop sprayer ; the 75-gal. low/medium volume trailer sprayer ; and the 20-gal. low volume tractor mounted sprayer.

Scottish Mechanical Light Industries Ltd. will be showing for the first time three new implements. These will be the Scotmec transport platform for replacing the loader and trailer for many jobs on the farm ; the Scotmec " Electromatic " fan type hammermill which is said to embody several original design features, resulting in high efficiency ; and the Scotmec 3 h.p. flange-mounted electric grain mower which is designed to meet the needs of the farmers limited to single-phase supply.

Steel Fabricators (Cardiff) Ltd., are exhibiting the Seligman Horn/draulic Grab with its wide range of attachments.

Tractor Lighting Sets

The latest Lucas tractor lighting sets have two headlamps with pilot bulbs to act as sidelamps. In the export version, a ploughing lamp is included. It possesses a special external switch which enables the driver to switch over to a red lamp built ' inside ' the ploughing lamp for use as a tail light when on the road at night.

Automatic Baler

A new automatic twine-tying baler, designed particularly for the farmer with smaller hay acreages, has been developed by the New Holland Machine Co. of Pennsylvania. It is stated that the outstanding feature of this new Model 66 is its pre-compression action. The machine has been tested in all parts of the country and in all baled crops, dry, semi-cured and green. It is designed especially for the farmer with smaller hay acreages and can be used with a one- or two-plough tractor. Low and compact, it is said to be easily manoeuvrable in small fields, over rough ground and in storage.

Among the new features of the machine is a pick-up and feeding action which is

Mr. Frank Perkins, who recently introduced a new high-speed diesel engine

said to combine compactness and high capacity. Other features include ' bird's eye ' visibility which allows the operator to look over the 4 ft. high baler to watch pick-up, tying and baling action without moving from the tractor seat. Dual wheels, available as optional equipment, can be mounted alongside standard wheels for extra tread in soft ground.

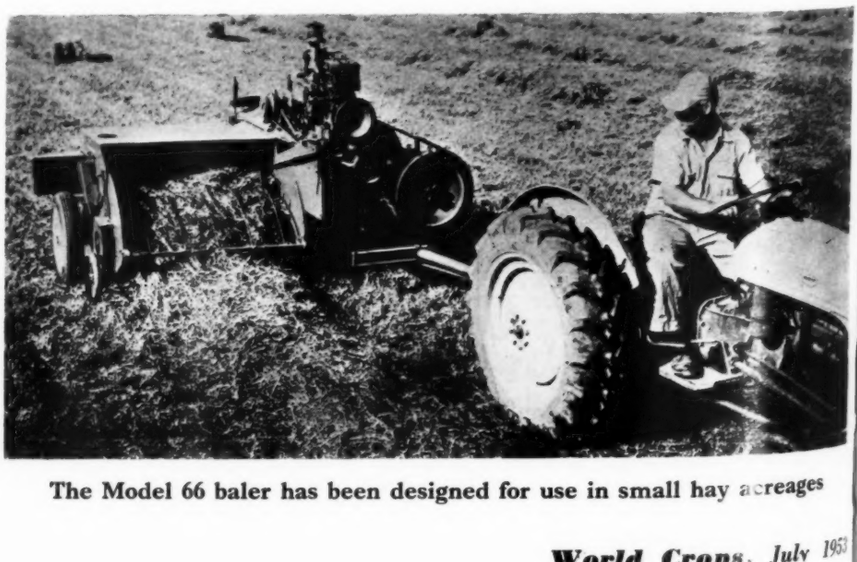
The pre-compression action is part of the new pick-up and feeding action. The 47½ in. wide pick-up handles full-size windrows. An auxiliary wheel guides the pick-up over field contours to make a ' clean sweep,' and adjustable wind-guards hold the hay to the power-driven pick-up for fast feeding. The feeder arrangement is stated to keep a positive pressure on the hay regardless of the size or density of the windrow. Reaching the all-steel fender, which has a rigid, open-end auger and a spring-supported floating bottom, the hay is moved into the pre-compression chamber. A special plunger compresses the hay before it reaches the wadboard, then the latter, built in horizontally to add to the machine's compactness, works on pre-compressed instead of loose hay, thus speeding up the bailing action and resulting in more and firmer bales.

A High-Speed Diesel

' The diesel engine has made much of modern mechanisation possible by its low operating and maintenance costs and its great reliability. Today there are 257 applications for Perkins diesel engines, and there are another 170 in project.' So said Mr. Frank Perkins, chairman of F. Perkins Ltd., on the occasion of the introduction recently of a new model Perkins high-speed diesel engine—the R.6.

It is a fact that the uses of diesel engines are becoming more and more evident, and these new applications are occurring in agriculture no less than in any other industry. The new Perkins diesel has been designed to meet the need for a prime mover of goods and passenger vehicles, which will enable comparatively high cruising speeds to be attained, such as are common for transport vehicles in Canada and the U.S.A.

The R.6, a six-cylinder unit with 4½ in. stroke and 4 in. bore, has 340 cu. in. piston displacement. It is rated as a vehicle engine to give 108 b.h.p. at 2,700 r.p.m. The engine incorporates the Perkins patented ' Aeroflow ' system of combustion. Main and big-end bearings are pre-finished and are stated to be replaceable in service without the necessity of carrying out boring or scraping operations. Press-button cold starting is fitted by means of two-series connected 12-volt batteries and, for exceptionally cold condition heaters are incorporated in the induction manifolds with a priming pump under Perkins patents.



The Model 66 baler has been designed for use in small hay acreages

WORLD CROP REPORTS

GUATEMALA

Cottonseed production.—Guatemalan production of cottonseed for crushing in 1953 is estimated at 6,300 tons, as compared with about 3,040 tons in 1952. Sesame production is also believed to have increased, possibly reaching 1,250 tons. Although the recent large harvests of both cottonseed and sesame may reduce imports of vegetable oils, relatively large imports of hog lard, butter, margarine, and tallow are expected to continue throughout 1953.

It is likely that as much domestic sesame seed as possible will be made available for export in 1953 since the export price is more attractive than the price in the domestic market. Export restrictions on Guatemalan sesame seed were lifted in November, 1952.

UGANDA

Cotton crop.—Cotton picking and marketing for the 1952-53 season has been completed in most parts of Uganda. Up to end-March the crop was 319,378 bales, compared with last season's total crop of 380,257 bales. Final figures are not yet available, but it is not anticipated they will exceed 320,000 bales.

The various provinces have all shown a drop on last season's figures, the biggest being more than 31,000 bales in Buganda and 25,000 in the Northern Province.

The weather was entirely responsible for this drop of about 60,000 bales. The planting rains were delayed and subsequent rains for growth were very much below the average.

It has been stated that the yield would have been poorer had it not been for the new variety of cotton seed, S47, introduced into the whole of the Northern Province, and the Eastern Province, with the exception of Busoga, and for the work of the seed-dressing stations operating in Buganda and the Eastern Province.

AUSTRALIA

Wheat harvest.—The Australian wheat harvest is now estimated at 179.8 million bushels, according to the latest figures issued by the Acting Commonwealth Statistician, Mr. S. R. Carver. This is 17 million bushels higher than the last forecast and is due to favourable weather conditions experienced in New South Wales, Victoria, Queensland and South Australia just before harvesting. The harvest will be about 40.3 million bushels below the record 1947-48 harvest, but 25.5 million bushels above average pre-war production. The estimated yield of 17.8 bushels an acre is equal to the record yield in 1949-50 and exceeds the average for the five pre-war years by 5.9 bushels an acre.

U.S.A.

Cottonseed.—United States exports of cottonseed and cottonseed oil in 1952 aggregated 70% more than in the previous year, but foreign sales failed to reach the high levels of 1949 and 1950. Cottonseed exports amounted to 11,273 short tons, compared with 7,153 tons in 1951, while oil exports were 53,639 tons against 31,564 tons the year before. Expressed in terms of seed equivalent 1952 shipments amounted to 357,330 tons, compared with 210,790 in 1951, 473,950 in 1950 and 397,690 tons in 1949. Increased exports in 1952 reflected the 50% expansion in 1951 seed production from the output of the previous year.

The bulk of the 1952 cottonseed exports —80%—and cottonseed oil exports—85%—went to other North American countries. Mexico alone took 8,051 tons of seed and 12,904 tons of oil. The leading market for oil, however, was Canada with purchases of 31,928 tons.

Winter wheat. A sharp reduction in the winter wheat crop is in prospect for the United States this year. The acreage seeded in the autumn was about half a million acres less than the large acreage of a year ago. It was still, however, well above average. The crop indicated on April 1 was 714 million bushels, compared with the large outturn of 1,053 million in 1952 and the average of 797 million bushels for the ten years ended 1951. The small crop is, however, better than was expected, on the basis of earlier season forecasts. The improvement over earlier prospects is due to unusually favourable weather during March and reflects smaller acreage losses than were expected. Acreage not harvested for grain is now forecast at 22% of seeded acreage, compared with 10% last year and 11.6% for the preceding ten years. Yield prospects have improved in most areas, but are still somewhat below average. Current prospects for 12.9 bushels per acre contrast with the heavy yields of 18.8 bushels a year ago and the average of 15.6 bushels for the ten years ended 1951. Moisture reserves are still low in many areas of the wheat belt, and the outcome of crops there will be dependent on timely rains for the remainder of the growing season.

INDIA

Jute production. The total area under jute cultivation in India in 1952-53 was 1,834,000 acres, producing 4,695,000 bales of 400 lb. each. The State Governments hope to increase acreage in 1953 by 94,000. The plan is to reach an acreage of 2 million by 1955-56.

PHILIPPINES

Rice prospects. Rice was not imported into the Philippines during the first half of 1953, and if the 1952-53 harvest turns out as large as expected, little, if any, foreign rice will be shipped in during the second half of the year. Rice imports in 1952 amounted to 139 million lb. The reduction in import requirements is due entirely to an increase in the current harvest.

The 1952-53 rice crop of the Philippines is estimated by the Philippine Bureau of Agricultural Extension at 6,717.6 million lb. of rough rice (4,700 million lb. milled), an increase of 478.9 million lb. (335 million lb.) as compared with the year before.

The increase in production this year is said to be due to favourable weather, high prices to producers, improvement of internal security, increased effectiveness in the control of pests, and assistance from the Mutual Security Agency.

Philippine milled rice imports during 1952 came from three countries—Thailand, Burma and the United States. The imports of 139 million lb. were all landed during the second half of the year. Earlier plans had called for the importation of around 300 million lb., but because the 1951-52 crop was better than expected, that was unnecessary.

Philippine rice prices during 1952 registered contrasting trends. The yearly average price paid to producers reached a level slightly higher than in 1951 while the average price to consumers was lower. Consumer prices also have moved down significantly since the beginning of 1953.

PAKISTAN

Rice crop. The third forecast of the area under rice crop in Pakistan for the year 1952-53 is 22,179,000 acres, against 21,655,000 acres reported in the third forecast of the previous year, showing an increase of 2.4%. The acreage reported in the final forecast of the previous year was 22,481,000 acres.

There has been an increase in the acreage of the crop in Baluchistan, East Bengal, the Punjab and Sind to the extent of 4.5%, 2.4%, 6.5% and 2.0% respectively. The increase in Baluchistan is due to the granting of general permission for rice cultiva-

tion in the Nasirabad sub-division of the Sibi District. The increase in East Bengal is attributed to favourable weather conditions at the time of sowing, high prices of rice and other food grains and the reclamation of waste lands. In Sind, the increase is ascribed to favourable conditions at sowing time. The decrease of 5.4% in the North-West Frontier Province and of 20.5% in Bahawalpur State is due, respectively, to unfavourable weather conditions and to short supply of canal water during the sowing period. A sharp decline of 52.9% in Khairpur State is attributed to the stoppage of rice cultivation in areas falling within the command of perennial canals, excessive rise in the subsoil water-table and consequent waterlogging.

The third forecast of the yield of the crop for the year 1952-53 is estimated at 7,796,000 tons of cleaned rice as against 7,414,000 tons reported in the third forecast of the previous year, recording an increase of 5.2%. The yield reported in the final forecast of the previous year was 7,745,000 tons. The increase in East Bengal is due to increased acreage and favourable weather conditions. Although there had been an increase in the acreage in Baluchistan, production declined by 5.3%. The decrease is due to inadequate supply of water. The reduction in the outturn in the North-West Frontier Province, Bahawalpur and Khairpur is due to decreased acreage under the crop.

Cotton prospects. The final forecast of the area under cotton crop in Pakistan for the year 1952-53 was 3,430,000 acres (American varieties 2,967,000 acres and Desi varieties 463,000 acres), as against 3,244,000 acres (American varieties 2,782,000 acres and Desi varieties 462,000 acres) reported in the final forecast of the previous year, showing an increase of 5.7%. The increase in respect of American and Desi varieties is 6.6% and 0.2% respectively. The acreage reported in the supplementary forecast of the previous year was 3,376,000 acres.

Except in the North-West Frontier Province and Bahawalpur State, there has been a general increase in the acreage of the crop in Pakistan, which is attributed to high market prices of cotton and favourable weather conditions at the time of sowing.

The final forecast of the yield of this crop for the year 1952-53 is 1,468,000 bales of 392 lb. each (American varieties 1,299,000 bales and Desi varieties 169,000 bales), as against 1,376,000 bales of 392 lb. each (American varieties 1,220,000 bales and Desi varieties 156,000 bales) reported in the final forecast of the previous year, registering an increase of 6.7%. The increase in respect of American and Desi varieties is 6.5% and 8.3% respectively. The production reported in the supplementary forecast of last year was 1,343,000 bales of 392 lb. each.

With the exception of East Bengal and the North-West Frontier Province, there has been a general increase in the production of this crop in Pakistan.

ARGENTINA

Wheat crop. The Argentine wheat crop this year is estimated at 285 million bushels. Acreage and yield were increased over last season and specific weight and grade of the wheat are said to be much above average. Yields have averaged about 16.9 bushels of wheat per acre this year, and a few areas reported yields of from 30 to 45 bushels per acre. About 125 million bushels are expected to be available for export this year.

WORLD

Maize production. World maize production in 1952-53 is estimated at 5,600 million bushels, which is 350 million bushels larger than the 1951-52 total and second only to the record outturn of 5,995 million bushels in 1948.

Supplies of maize available for export from the principal exporting countries appear larger than they were last year. The Argentine harvest is forecasting about double the small outturn of a year ago. Stocks remaining from that small crop are negligible, but exportable supplies from the new crop appear likely to be about 75 million bushels. Though somewhat below the pre-war level of exports, a movement of that volume would be the largest of recent years.

Supplies of maize in the United States at the beginning of the season, October 1952, were 158 million bushels larger than supplies a year earlier, since the large crop more than offset a decline of about 250 million bushels in carryover stocks.

The outturn in North America is estimated at 3.517 million bushels, an increase of 13% over the 1951 harvest and 44% over the pre-war level (1935-39).

Total maize production in Europe is estimated at 475 million bushels, compared with the near-average harvest of 690 million in 1951. Reductions from the 1951 level were principally in the important producing Danube Basin area, where severe drought made sharp reductions in late-summer crops. The outturn was also smaller in Italy, the other important maize producer in Europe.

The maize harvest in the Soviet Union was indicated to be above that of 1951, though still not up to the pre-war average of 170 million bushels. The reduction from the pre-war level is attributed to reduced acreage.

Production in Asia is now estimated at 700 million bushels, a near-record harvest for the area, contrasting with the 1951 crop of 670 million and the pre-war average of 620 million. The acreage planted to maize was the largest of recent years and well above the pre-war level.

The production in Africa is estimated at 270 million bushels. This is above average though not up to the 1950 total of 290 million bushels. Acreage was well above average.

The harvest in South America is forecast at 480 million bushels, an increase of 40 million over the previous estimate. That increase is due to improved prospects for Argentina, where the crop is now forecast at 160 million bushels, contrasted with 80 million a year ago and 105 million in 1951-52. The current crop would still be sharply below the pre-war average of 302 million bushels.

Winter wheat. The outlook for the world winter grain crops is less favourable than the outlook a year ago. Winter wheat, the principal autumn-sown crop, normally accounts for about 75% of the world wheat acreage, with the bulk of the wheat acreage autumn-seeded in all important producing areas except the Soviet Union and Canada.

Pre-war averages for the Soviet Union indicated about 35% of all wheat acreage was in winter wheat. In Canada, winter wheat covers an even smaller percentage, with autumn-sown acreage averaging 5% or less of total wheat acreage.

The less favourable outlook this year comes about through reduced seedings in a number of important producing areas and also less favourable growing conditions. Lack of adequate moisture is causing concern over wide areas. In still other parts, especially the Netherlands and the United Kingdom, serious floods caused extensive crop losses.

HUNGARY

Rice prospects. New rice plantations with a total area of 15,300 acres have been established in Hungary this year. In one new farm alone this involved the cutting of 37 miles of irrigation canals and the building of 48 miles of dykes.

Until 1944, rice was grown in Hungary on only 12,000 acres of land. It was planned by the end of 1954 to turn over 72,000 acres to rice, but progress has been so good that it is expected this target will be exceeded.